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CONTENTS

Abstracts of Principal Articles

The Production of Stub-axles for Volvo Cars ..... P. 700

At the works of A.B. Bolinder-Munktell, Eskilstuna, Sweden, who are associated with A.B. Volvo, Gothenburg, a special department is engaged in producing "front end" components for Volvo cars, trucks and buses. In a separate section of this department, 29 operators produce stub-axle assemblies for the Volvo type PV-444/45 car, at a rate of 400 assemblies per 8-hour day. A high standard of efficiency is maintained by the use of advanced time-study methods, in conjunction with a machine grouping system. Forgings for the stub-axles are centred on a Fertungsmittel special-purpose machine, and the axle-portions are rough and finish machined on two +GF+ copy-turning lathes. Another special-purpose Fertungsmittel machine is employed for machining a reference-face and a keyway simultaneously, and, at a later stage, the gaps between the king-pin bosses are gang-milled on two components at a time, on a Sundstrand machine, in a floor-to-floor time of 1·52 min. per pair. A large Huller special-purpose, multi-spindle, indexing-drum machine is employed for drilling and boring the king-pin holes, which are subsequently fine-bored on a Heald 4-spindle machine, and bushed. The bushes are fine-bored on an adapted Munktell high-speed lathe. Before the bushes are inserted, the flange holes are drilled and reamed, and the grease-nipple holes are drilled and tapped, on another Hüller special-purpose machine. (MACHINERY, 92—28/3/58.)

Production and Assembly of Strips for Mikrokator Movements ..... P. 713

In this second article concerned with some of the methods and equipment employed by Aktiebolaget C. E. Johansson, Eskilstuna, Sweden, for producing their Mikrokator indicating instruments, the rolling and twisting of the very thin strip material, used in the amplifying mechanism of these instruments, is discussed. Some of these strips are only 0.0025 mm. (0.0001 in.) thick, and a special rolling technique is necessary. The same technique is employed for rolling the aluminium-alloy foil, used for the "visible" portions of the pointers, which is only 0.001 mm. (0.00004 in.) thick. Twisting is performed with the aid of small fixtures, by highly-skilled girl operators. (MACHINERY, 92—28/3/58.)

A New Single-operation Precision Blanking Press ..... P. 724

The Swiss tool-making firm of Heinrich Schmid, in conjunction with the builders of SMG hydraulic presses, have developed a single-operation precision blanking process, which is claimed to produce blanks from sheet or strip metal with a finish on the edges that is equivalent to that obtained by shaving, or by grinding. The process can be applied to a wide range of metals, with thicknesses varying from 0·060 to 0·315 in., and outputs of about 600 to 800 pieces an hour can be maintained. Presses in four sizes have been developed for this technique, the latest types having provisions for mounting strip-feeding equipment. (MACHINERY, 92—28/3/58.)

Nozzle and Sprue Design for Gooseneck Die Casting Machines ..... P. 727

In this article, some designs of nozzles that are in current use on gooseneck die casting machines are examined. Certain criticisms are made and a simple form of nozzle is advocated. The author then goes on to discuss some causes of nozzle drip, and discusses some methods of removing broken sprues. Next, the need for sprues of adequate size is emphasized, and recommendations are made with regard to nozzle heating. Other sections of the article are concerned with the timing of the dwell period for manually-controlled die casting machines; developments in sprue design; water cooling arrangements for sprue pins; standard sprue pins and bushes; the importance of unrestricted metal flow; the desirability of reducing the weight of "dead metal"; and advantages of the divided sprue. (MACHINERY, 92—28/3/58.)

Fordath Shell Moulding Developments P. 736

The Fordath Engineering Co., Ltd., have introduced a range of liquid phenolic resins for pre-coating sand that is to be used for the production of shell moulds and cores, and have also installed plant for pre-coating sand for sale under the name of Plastsand. Resins can be supplied for application to sand while cold or heated, and the company can provide the necessary mixing equipment for users who wish to process their own sand. (MACHINERY, 92—28/3/58.)

Contributions to MACHINERY

If you know of a more efficient way of designing a tool, gauge, fixture, or mechanism, machining or forming a metal component, heat treating, plating or enamelling, handling parts or material, building up an assembly, utilizing supplies, or laying out or organizing a department or a factory, send it to the Editor. Short comments upon published articles and letters on subjects concerning the metal-working industries are particularly welcome. Payment will be made for exclusive contributions.

IN FORTHCOMING ISSUES

Producing the Vauxhall Victor—The production of ball and roller bearings—Tungsten carbide lamination die—Automatic gauging and marking machine for taps.

Tape-controlled System for the Inspection of 3-dimensional Shapes

One of the most important developments in the metal-working field during the past decade has been the introduction of control systems whereby the movements of machine tool members for producing components of various shapes are determined solely by information provided on tape. Progress in this connection has been rapid, and such systems are already finding important practical applications, although various problems associated with the mechanical design of machines remain to be solved before full advantage can be taken of the potentialities. The benefits to be derived from these methods of control have frequently been discussed, and here it is only necessary to point out that they can be of particular value where complicated 3-dimensional shapes must be machined, for example, for aircraft structural members. However fundamentally accurate and consistent the control system may be, the quality of the finished work will obviously be influenced by various factors, including machine alignment and rigidity, sensitivity of movement, and cutter deflection and wear. It follows that the problem of final inspection remains, and where the workpiece is both large and intricate, checking by orthodox methods may involve considerable time and cost.

For this reason, great interest will doubtless be aroused by a paper which was presented by Mr. H. J. Elton, of the Ministry of Supply Inspectorate of Electrical and Mechanical Equipment, at the conference on Technology of Engineering Manufacture, recently staged by the Institution of Mechanical Engineers. In this paper, a system was described whereby such 3-dimensional forms can be automatically inspected. For this purpose it is necessary to provide a measuring head which will indicate movement in three co-ordinates, and a suitable head has been designed. When this head is mounted on a machine equipped for tape control, the work can be caused to follow a programmed path so that all the surfaces to be inspected are successively carried past a stylus point. If the dimensions of the work depart from those of the path through which it is moved, movement is imparted to the stylus and the deflection can be indicated or recorded.

When it is required to inspect the size and position of a hole, for example, the work is traversed until the theoretical centre is aligned with the stylus, and then it is raised so that the stylus enters to the specified depth. Next, the work is moved so that the wall of the hole is brought into contact with the stylus, and then it is caused to make a circular movement. It is reported that the system has been tried out on a production milling machine with very promising results. To enable a higher standard of accuracy to be achieved, a jig boring machine is now being converted for the purpose. At the same time, a special machine is being designed solely for inspecting workpieces by tape control.

Obviously this development is of the greatest importance, and it is pointed out that the method can be applied to any component within the capacity of the available equipment, whether or not it has been produced on a computer-controlled machine tool. Apart from the fact that this system of inspection is rapid and requires no skill, by reason of the "continuous" nature of the operation, it is more searching than the normal checking procedure. For instance, the surface of a hole is not usually checked over the complete circumference. It is possible, moreover, to magnify the errors of a component to any desired extent on the indicating meter or recorder, by adjustment of the amplifying system.

Tapes for inspection are prepared in the same manner as those employed for the control of machining operations, the necessary information being obtained from drawings of the components dimensioned from three datum planes. These tapes can readily be stored for use when further batches of components are being produced. Copies can also conveniently be supplied to firms in other areas, and in different countries, so that uniformity of inspection procedure can be ensured. A further advantage lies in the fact that if the design of a component is modified during a production run, a new tape can quickly be provided, and there is no delay while gauges are being altered. It is also pointed out that the chart records obtained can be filed for reference, and that it is unnecessary to prepare the usual dimensional reports.

When tape-controlled inspection machines become available it seems likely that they will be widely adopted, particularly where complicated parts must be produced singly or in comparatively small numbers to close limits of accuracy. They should be of considerable assistance, for example in tool-rooms and in shops concerned with the construction of machine tools and other precision machinery, quite apart from their obvious applications in the aircraft field, where interest in computer-controlled machining is at present largely centred.

The Production of Stub-axles for Volvo Cars

Methods Employed by A. B. Bolinder-Munktell, Sweden

The factory of A. B. Bolinder-Munktell, who are associated with A. B. Volvo, Gothenburg, is the largest in the Swedish industrial centre of Eskilstuna, and provides employment for about 2,750 people. Of this number, some 1,900 are directly engaged in the manufacture of the company's wide range of products, which includes motor vehicle, industrial and marine diesel engines; diesel-engine power-pack generator- and compressor-sets; road graders; four basic types of tractors; and three sizes of combine harvesters. Half of the tractors purchased for agricultural work in Sweden are supplied by the company, and the assembly lines are organized to deliver, on average, one tractor every 14 min.

The origins of the factory date from 1832, when Johan Theofron Munktell set up engineering shops to provide machines and tools for the local mills. Subsequently, in 1848, these shops produced Sweden's first steam locomotive, and later, mobile steam-engines, threshing machines, and tractors. Meanwhile, the brothers Jean and Carl Gerhard Bolinder had established an engineering works and foundry in Stockholm in 1844, and in 1870 had started making wood-working machines of improved design. Later, engines were produced, and in 1932 the Bolinder company moved to Eskilstuna and amalgamated with the Munktell organization, thus bringing into existence the firm of A. B. Bolinder-Munktell. Subsequently, in 1952, the company produced the first Swedish-built diesel tractor, the BM 35/36.

The present factory is of considerable extent, and is almost entirely self-contained. Facilities include a modern mechanized foundry, with a capacity of 40 tons of castings per working day. This output comprises, exclusively, castings for the company's diesel engines and tractors. In the core-making section, the equipment includes a Sutter core-blowing machine. Fully automatic, this machine has a capacity of 120 cores per hour, each weighing 30 kg. (66 lb.) and is stated to be the only one of its kind in Northern Europe. Larger cores are produced on an Osborn core-blowing machine, and the mould-making section is arranged for the preparation of moulds of various sizes, for castings up to an individual weight of 250 kg. (550 lb.). Melting is carried out in two cupola furnaces, which have a combined capacity of 6 tons per hour. In the fettling section, the cleaning equipment includes a +GF+ airless shot-blasting machine.

Fig. 1. Typical Group of Stub-axle Assemblies and Components for Volvo Cars, Trucks and Buses, Produced in the Axle-shop at the Works of A. B. Bolinder-Munktell

THE AXLE SHOP

Throughout all departments of the factory, a high standard of efficiency is maintained by means of advanced and closely co-ordinated time-study methods, based on the American M.T.M. system. These methods are effectively applied, for example, in the axle shop, which is a separate department devoted exclusively to the production of "front end" components for Volvo cars, commercial vehicles and buses. The components manufactured include such items as stub-axles, steering-gear linkages, and steering-gear arms, and in some instances they are supplied to A. B. Volvo as sub-assemblies.

Typical components are shown in Fig. 1, including (top row, left to right) a stub axle for buses and large vehicles, and two similar units for lighter vehicles; (centre, left to right) a stub axle for the Volvo P-1200 Amazon car, and an intermediate steering-arm assembly and steering arm, for the same vehicle; and (bottom, left to right) a stub axle and corresponding support fitting for the Volvo PV-444/45 car, an assembly of these units, and a pair of upper pivot shaft brackets.

The axle shop, in which 125 men are employed, is divided into six sections, as follows: PV-444/45 production; lorry and bus stub-axle production; steering-gear arm production; front axle production; general king pin and stub-axle section; and a general section. The PV-444/45 production section, which it is here proposed to discuss, was completely re-equipped and reorganized during 1955, in accordance with the time-study methods already mentioned. As a result of this rationalization, the total production time for each stub axle assembly, A, Fig. 1, was reduced from 1·72 hr. to 0·52 hr. The line devoted to the machining and assembly of these components is manned by 29 operators, and it is organized to produce 400 assembled units in each 8-hr. working day.

In proportion to this output, the floor-area occupied is small, and the machines are arranged fairly close together, so that only a minimum distance need be covered in transferring the components from one machine to the next. This arrangement is in accordance with a machine grouping system, whereby each operator tends several machines, and idle time of both machines and operators is kept to a minimum. Where appropriate, roller-track conveyors are provided, which afford buffer storage capacity between the machines, sufficient for four or five hours' production.

The components of the PV-444/5 stub axle assemblies are machined from forgings in nickel-chromium steel, to a Volvo specification, and of the following composition: nickel, 1·10-1·40; chromium, 0·70-0·90; manganese, 0·70-0·90; carbon, 0·35-0·42; and silicon, 0·15-0·40 per cent, with phosphorus and sulphur not exceeding 0·035 and 0·03 per cent, respectively. These forgings are received fully heat-treated to an ultimate tensile strength of 90 kg. per sq. mm. (57 tons per sq. in.) and a Brinell hardness between 269 and 302.

INDEXING WORK FIXTURE FOR CENTRING

Wherever possible, the machines are tooled to handle both right- and left-hand parts. Where such an arrangement is impractical, and it is necessary to change the set-up according to the

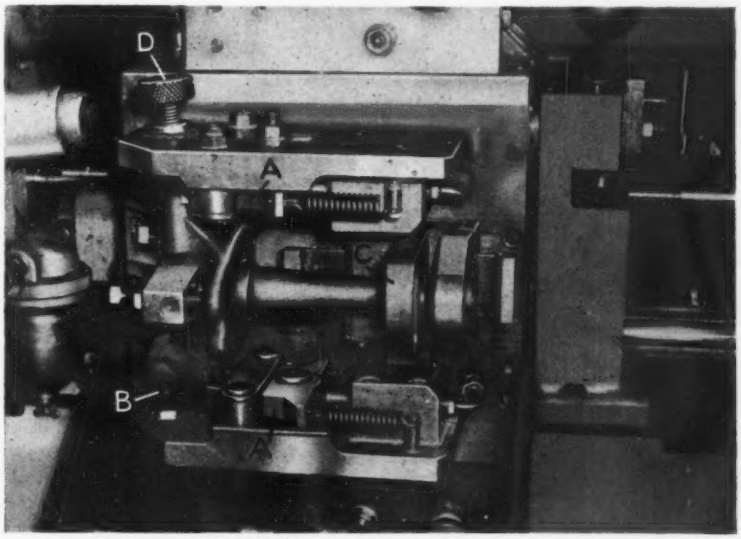


Fig. 2. Close-up View of One of the Fixture-stations on the Fertungsmittel Machine, Showing the Clamping and Locating System

"hand" to be machined, the components are processed in batches of 1,000 of each hand. At the first station in the PV-444/5 stub-axle line, the forgings are centred at both ends simultaneously on a machine of the opposed-spindle type, supplied by Dr. Georg, Fertungsmittel G.m.b.H., Hagen i/w, Germany, which is equipped with the 4-station indexing fixture shown in Fig. 2.

On this fixture, which is arranged to index about a horizontal axis, there are two stations for right-hand components, and two stations for left-hand components. The drilling spindles are located towards the rear of the machine, and the working cycle is as follows. Only two stations are used at any given time, depending on the hand of stub-axle that is being centred, and loading is carried out at the front, while machining is in progress at the rear. On completion of the automatic machining cycle, the spindles are withdrawn, and the machine stops. The fixture is then indexed through 180 deg., manually, so that the newly-loaded component is aligned with the drilling spindles, and the next automatic cycle is started. For components of the opposite hand, the other two stations of the fixture are employed.

Each station is equipped with pneumatically-operated clamping and locating members, which are controlled by means of a pedal. Referring to Fig. 2, there are three such members, arranged to slide horizontally, two of which, indicated at *A*, are of V-form at the forward end. Each of these

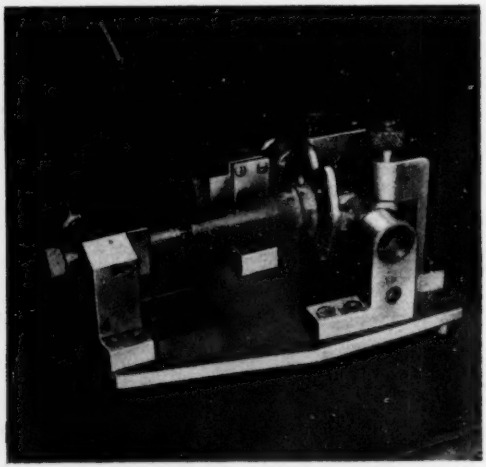


Fig. 3. The Fixture Here Shown is Employed for Checking the Machine Settings for Individual Batches of Forgings, to Determine whether they have been Centred to the Best Advantage

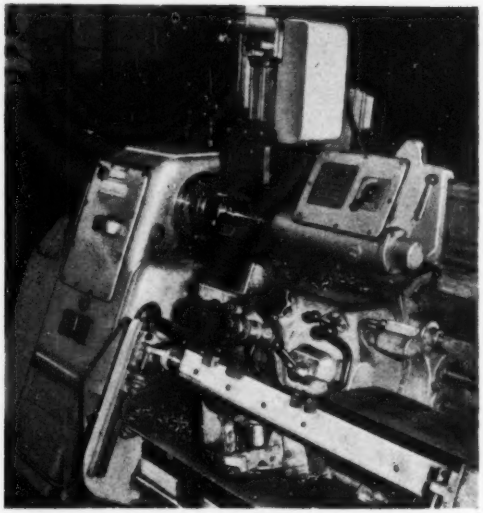


Fig. 4 This +GF+ Type KDM 11 Copy-turning Lathe is Employed to Machine the Forgings to the Dimensions Indicated in Fig. 5.

members, which moves between a pair of guide rollers, is advanced by a single-acting air-cylinder, and returned by tension springs. The vees on these members engage the king-pin bosses, and serve to hold the flange of the component against three adjustable screw locating stops. They also locate the bosses so that their axes are vertical. For vertical location of the component at the flange end, there is another adjustable stop-screw, which engages the under-side of the steering-arm boss.

The third pneumatically-operated locating member *C* is mounted on a small horizontal slide, and has a bushed hole which engages the tapered outer end of the shaft portion of the component. When the fixture is to be unloaded, the finger-screw *D*, which holds the work down against the stop-screw *B*, is slacked-off, and the control-pedal is depressed so that the pneumatically-operated members are withdrawn. At this stage, the member *C* is retracted slightly in advance of the V-members *A* to ensure that the bush is stripped from the end of the shaft. When loading a component, it is placed loosely in position against the locating stop-screws, with the king-pin bosses approximately in line with the vees of the members *A*. It is then slid slightly to the right, so that the tapered outer end is just engaged with the bushed hole in the member *C*.

When the pedal is released, all three members are advanced, and the finger-screw *D* is then tightened. The bush in the member *C* serves to centre the end of the shaft in relation to a guide bush *E*, which is carried in an arm mounted on the same horizontal slide as the member *C*. For guiding the left-hand centre drill, there is a bush in the member at that end of the fixture which carries the flange face stop-screws.

When the loaded fixture is indexed to the working position and the automatic cycle is initiated, the spindles, which run at 610 r.p.m., are first advanced rapidly, and then at a feed rate of 0·004 in. per rev. At the end of the stroke, the spindles are rapidly withdrawn, and the fixture lock is automatically released in readiness for indexing. Before the next cycle is initiated, the indexing lock is re-engaged manually, by means of the knob seen at the upper right. With this set-up, each component is centred in a floor-to-floor time of 0·38 min.

When starting on a batch of forgings, a sample is set-up, after it has been centred, in the small checking fixture shown in Fig. 3. In this fixture, the work is held between centres, and is angularly located, about the axis through the centres, by a vee and a hold-down screw which engage one of the king-pin bosses. Arranged in line with the faces of the king-pin and steering-arm bosses, there are lugs with bores in which rotatable plugs can be inserted. Before the forging is loaded into the fixture, the faces of the bosses are chalked, and when it is in position, a reference circle is scribed on each of these faces, by means of a point in the rotatable plug. After the work has been removed from the fixture, it can be ascertained, from these circles, what adjustments, if any, should be made to the locating stop-screws and vees of the centring machine, in order that the forgings may be centred to the best advantage for the subsequent machining operations. Adjustment to the vees, it may be noted, is obtained by means of eccentric pins, on which the guide-rollers rotate.

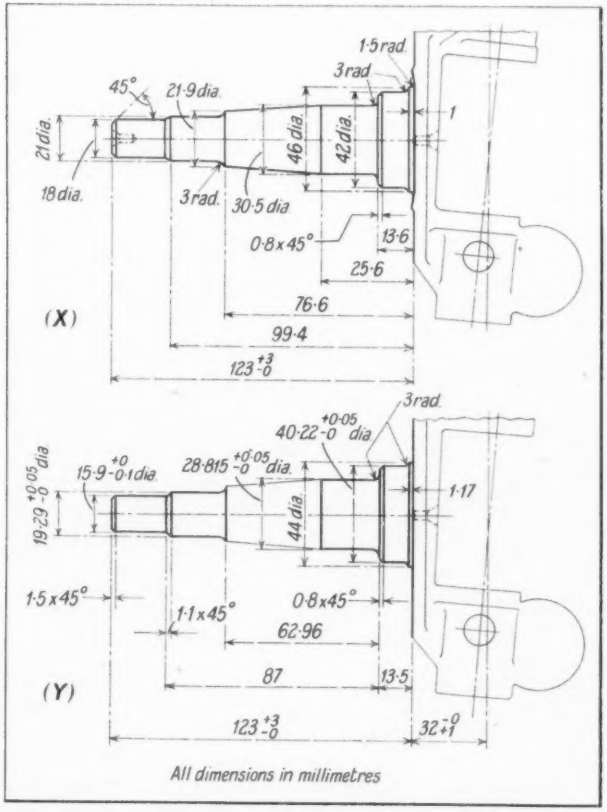


Fig. 5. Sketches Showing the Dimensions and Tolerances to which the Components are Machined on the First (view X) and Second (view Y) + GF + Copy-turning Lathes

COPY TURNING OPERATIONS

For rough and finish machining the shaft portion and adjacent flange face of the forging, + GF + copying lathes are employed. At the first stage the taper is finish turned and the remaining portions are brought to the dimensions indicated in the view at *X* in Fig. 5, on the type KDM 11 machine shown in Fig. 4. This lathe, it may be noted, has a power-operated upper slide. The work is held between centres, and a cylindrical member, mounted on the spindle nose, is recessed to accommodate the king-pin and steering-arm bosses, and provides for driving.

When the automatic cycle is started, the work is run at 710 r.p.m., and the copying-slide tool advances, and begins cutting on the outer end of the shaft, to form the 45-deg. chamfer. Then, it is fed along at 0·022 in. per rev. to turn the 18-mm. and 21-mm. (0·709- and 0·827-in.) diameters, and the tapered portion. Shortly after the tool has begun to

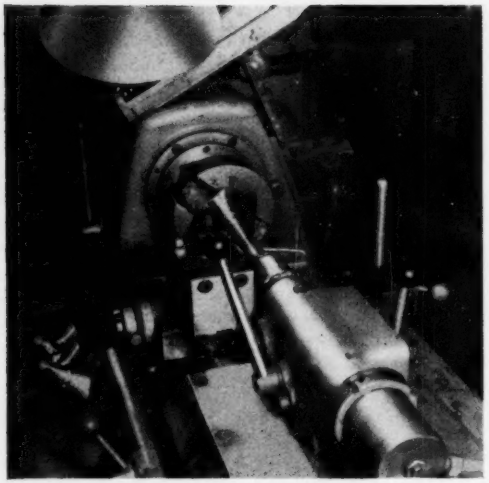


Fig. 6. The Components are Threaded on the Type B Cri-Dan Machine Here Shown

turn the taper, the upper slide is advanced, and starts to cut on the flange face with a feed of 0·012 in. per rev. At this stage, the work-speed is reduced to 250 r.p.m.

When the copying-slide tool has traversed appproximately two-thirds of the length of the taper, the upper-slide tool has advanced sufficiently across the flange face to permit an increase in work-speed to 500 r.p.m. This speed is maintained for the remainder of the cycle, with the feeds already indicated. The upper-slide tool is withdrawn before it reaches the 46-mm. (1·811 in.) diameter, at the junction of the 3-mm. (0·118 in.) and 1·5-mm. (0·059 in.) corner-radii between the shaft and the flange. These radii are machined by the copying-slide tool, which then withdraws obliquely and returns to the starting position. Finally, the machine stops in readiness for unloading. A slight ridge left on the flange face, between the portions machined by the facing and copying-slide tools, is removed during the second copy-turning operation.

At the set-up just described, the depth of cut of the copying-slide tool varies from 0·08 in. to 0·16 in. and that of the upper-slide tool, from 0·12 in. to 0·2 in. The depth of cut is irregular throughout, on account of the die parting-line on the forging. Solid carbide tips, of grade S.4 Sandviken Coromant, are employed. The tip for the copying-slide tool is of rhombic section, and is double-ended and reversible, so that two cutting edges, with chip-breaker grooves, are provided. Each cutting edge will machine 100 components per regrind. Of circular section, the tip of the upper-slide tool can be turned and inverted to present four different portions of the cutting-edge at each end. This tool will machine 35 components for each setting, so that a total of 280 components can be faced per regrind. At this set-up, the floor-to-floor time per component is 0·62 min.

The two +GF+ machines are tended by one operator, who unloads and reloads one, during the working cycle of the other, and the working cycles of the machines and the operator are carefully balanced. At the second stage, for which a type KDM 11 machine, without an upper slide, is employed, the work is finish turned to the dimensions shown at Y in Fig. 5, in a floor-to-floor time of 0·67 min. The method of holding and driving the work is the same as for the first stage, and a similar, solid carbide, copying-slide tool-tip is employed.

Initially, the work is run at 1,000 r.p.m., while the portions of the shaft on either side of the taper are finish turned at a feed of 0·018 in. per rev. As it passes from the 19·29-mm. (0·759-in.) diameter to the 28·815-mm. (1·134-in.) diameter, the tool is withdrawn clear of the taper. When the tool reaches the shoulder of the 40·22-mm. (1·583-in.) diameter portion, the work-speed is reduced to 355 r.p.m., for turning this portion and facing the flange. For the latter operation, the tool is withdrawn radially at a feed of 0·015 in. per rev. Finally, the tool returns to the starting position, and the machine stops. The finish-turned component is unloaded and placed in a pallet on a roller-track adjacent to the two machines, on which it is conveyed to the next line-station.

Here, there is a group of three machines, also tended by one operator, on which the end of the spigot is threaded, a keyway is cut, a face is machined on one of the king-pin bosses for location purposes at subsequent operations, and two holes, at right-angles to each other, are drilled through the threaded portion. A 16-mm. (0·630-in.) diameter by 1·5-mm. (0·06-in.) pitch thread is cut on the type B Cri-Dan machine shown in Fig. 6, on which the work is held between centres, and driven in the same manner as on the +GF+ machines. A triangular solid carbide reversible tool-tip, of Fagersta Bruks A.B. grade S.41 Seco material, is employed, which provides a total of six cutting edges, and the work is run at 1,578 r.p.m. The thread is cut in 14 passes—although 12 would suffice—to ensure a cycle-time correctly balanced with those of the other machines in the group, and increased tool-life between regrinds.

The keyway is machined, and the location face on one of the king-pin bosses is milled at the same setting, on the Dr. Georg, Fertungsmittel special-purpose machine shown in Fig. 7. This machine has three vertical spindles, and a reversing-feed table equipped with two pneumatically-operated fixtures. One fixture is loaded while the other is in use, and the centre spindle carries a 25-mm. (0·984-in.) diameter, 5-mm. (0·197-in.) wide cutter, with 12 teeth, which is run at 190 r.p.m. This cutter is employed to machine the keyway in the threaded portions of the components in both fixtures. The two outer spindles are equipped with 19-mm. (0·748 in.) diameter, 8-tooth facing-cutters, which are also run at 190 r.p.m., and machine the location faces on the components in the corresponding fixtures.

Each fixture has a pair of vees, which engage the parallel portions of the spigot on either side of the taper, and serve to locate the work approximately, during loading. These vees support it in line with a pair of centres, one of which is pneumatically operated, and the other fixed. When the work has been placed in the vees, and the pneumatically-operated centre advanced, the cross-shaft A is turned by hand-lever. This shaft carries a pair of cams that engage the under-sides of the king-pin bosses, which are thus aligned and held in the horizontal position. The two fixtures are arranged to hold the stub axles with the threaded ends towards the centre spindle.

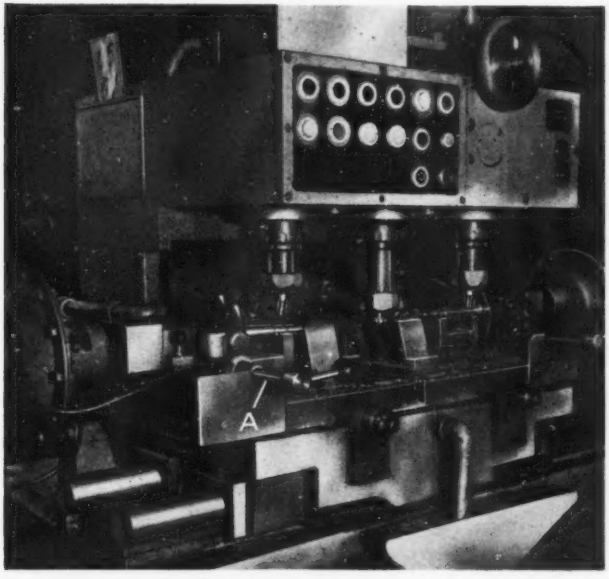


Fig. 7. On This Special-purpose Fertungsmittel 3-spindle Machine, the Key-slot, and a Reference-face on One King-pin Boss, are Machined Simultaneously on Each Component

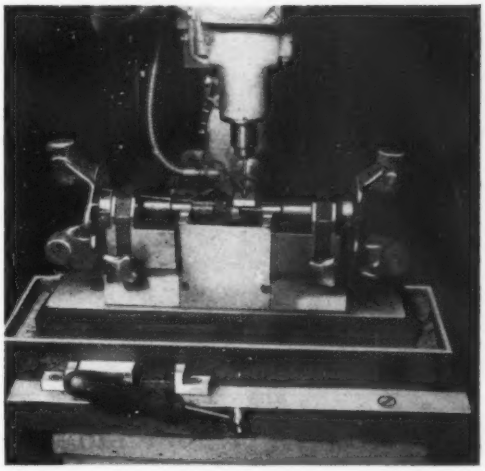


Fig. 8. This Special-purpose Gemo Machine is Employed for Drilling Two Holes, at 90 Deg. to Each Other in the Threaded Ends of the Spigots

Milling is carried out by the shuttle method at a feed rate of 2·76 in. per min., the table being automatically reversed at the end of each traverse, and the fixtures loaded alternately. As may be observed from Fig. 7, the pneumatic units for operating the movable centres are of the short-stroke diaphragm type. They were supplied by Svenska Stålpressnings A.B., Olofström, Sweden.

A small buffer stock of components is maintained between the three machines, and the operator, having loaded a component into the Cri-Dan machine and initiated the automatic cycle, proceeds to the Fertungsmittel machine, where he unloads and reloads one of the fixtures, and then to the third machine in the group, which is shown in Fig. 8. Supplied by Industriaktiebolaget Gemo, Stockholm, this machine has two cam-operated heads, one vertical and one horizontal, which provide for drilling the holes in the threaded portion of the spigot. This machine, again, has two fixtures, one of which is loaded

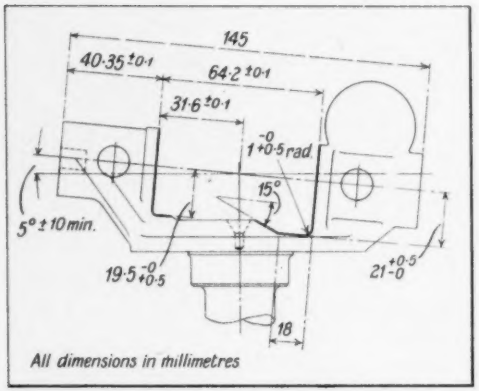


Fig. 9. View Showing the Dimensions and Tolerances of the Fork Gap and Bosses which are Gang-Milled at the Set-up Seen in Fig. 10

while the workpiece in the other is being machined.

Each fixture has a pair of vees to support and locate the work horizontally from the parallel portions adjacent to the thread and the flange. Axial location is taken from the machined flange face, and the work is located angularly by pins that engage the profiled edge of the flange. It is held in the vees by a single bell-crank type clamp, tightened by means of a finger-screw.

When the operator reaches this machine, an automatic cycle is nearing completion. By the time he has loaded a fresh component into the second fixture, the cycle has ended and the spindles have withdrawn and stopped. He then indexes the freshly-loaded fixture into the working position, by traversing the table against a stop with the aid of a hand-lever. Next, he starts the automatic cycle, unloads the drilled component, places it in a pallet on the roller-track conveyor, and returns to the Cri-Dan machine. It may be noted that in addition to loading the three machines, the operator carries out certain dimensional checks.

The electrically-driven spindles of the Gemo machine run at 1,000 r.p.m., and the feed of the 3-mm. (0·118-in.) diameter drills is 0·002 in. per rev. In the operating position, the threaded end of the work in either fixture is prevented from lifting by a stationary member, of inverted-L shape, which is provided with guide bushes for the vertical and horizontal drills. The feed-cams are so arranged that the vertical spindle is advanced ahead of the horizontal spindle, and retracts before the drill in the horizontal spindle breaks into the vertical bore. Both holes are drilled through the work. At the group of three machines described, the cycle-time per component is 0·88 min.

MACHINING THE FORK GAP

At the next stage, the fork gap, and the outer faces of the king-pin bosses, are machined to the dimensions indicated in Fig. 9, with the gang-milling set-up shown in Fig. 10. The machine employed is a Swedish-built Sundstrand No. 11 Rigidmil, made under licence by Köpings Mekaniska Verkstads A.B., a member firm of the Volvo group. This machine is equipped with an air-hydraulic four-station fixture, with two stations at each end, two of which are loaded while components in the others are being milled. At each station, there is a block which is bored horizontally to accommodate the shaft portion of the component, and to locate it by the 40·22-mm. (1·583 in.) diameter. The front of the block serves to locate the machined face of the flange.

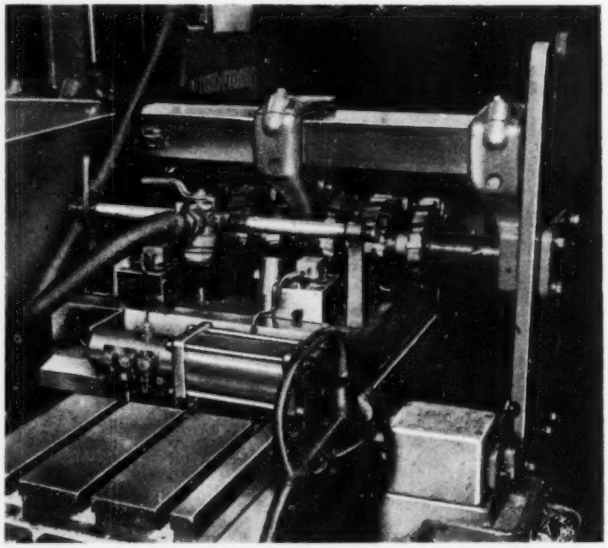


Fig. 10. At This Set-up, on a Swedish-built Sundstrand No. 11 Rigidmil, a Gang of Eight Cutters Machines Two Components to the Dimensions Indicated in Fig. 9

At the two stations at the left-hand end of the fixture, angular location of the component, about the axis of the shaft portion, is provided by a pad, mounted on the fixture base. This pad engages the datum-face machined on one of the king-pin bosses, and supports the latter from below. A hydraulically-operated plunger, which is arranged to engage the underside of the second boss, ensures that the boss with the machined datum-face is held firmly in contact with the pad. In this way, the work is adequately supported from below, to withstand the cutting loads, which are in a downward direction. At the two stations at the right-hand end of the fixture, the cutting loads are in an upward direction, and the work holding and locating arrangements are similar, but inverted as compared with those at the left-hand stations. At each station, the work is clamped by a vertical hydraulic plunger, which engages the shaft portion just beyond the 40·22 mm. (1·583 in.) diameter.

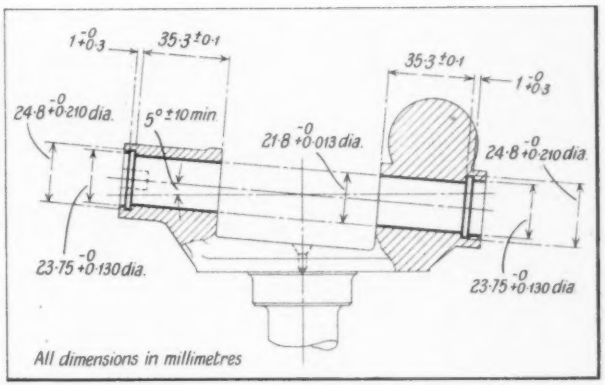


Fig. 11. The King-pin Bosses are Drilled, Recessed, and Fine-bored, to the Dimensions Indicated, on the Hüller Special-purpose Machine Shown in Fig. 12 and 13

The 50-mm. (1·968 in.) diameter arbor carries a gang of eight cutters, in two groups of four, between which there is a centre steady. The two outer cutters in each group, which mill the ends of the king-pin bosses, are of the side-and-face type, of 7·87 in. diameter, with 16 inserted high-speed steel teeth, with chip-breaker grooves. The cutters forming the inner pair of each group are clamped together side-by-side, with the teeth staggered. One cutter of the pair, which also machines the profiled portion of the flange seen in Fig. 9, is correspondingly profiled, and is 0·12 in. larger in diameter than the other. For this operation, the spindle speed is 31 r.p.m.

The machine-table is automatically reversed at the end of each stroke and is traversed rapidly to bring the freshly-loaded components to the cutters. It is then slowed to the cutting feed of 1·38 in. per min., and while the operation is in progress, the operator unloads and reloads the other fixtures, and de-burrs the two machined components. The floor-to-floor time for this stage is 0·76 min. for each component.

MACHINING THE KING-PIN BORES

At the next stage, the king-pin holes are drilled, recessed, and fine-bored to the dimensions shown in Fig. 11, and these operations are carried out on a large Hüller special-purpose machine. A view of this machine, from the rear, is given in Fig. 12, and it is of the indexing drum type with eight spindles, arranged in opposed pairs. Each spindle is driven by a 3½-h.p. motor, and the two pairs of spindles towards the front of the machine provide for drilling the holes, in two stages. These spindles are fed inwards and withdrawn mechanically, on account of the heavy loads entailed, and the feed mechanisms incorporate clutches, which slip in the event of overload. The remaining two pairs of spindles, towards the rear of the machine, which perform the recessing and finish-boring operations, are advanced and retracted hydraulically.

The indexing drum is shown in the close-up view in Fig. 13. It carries a series of fixtures, which are presented to each pair of spindles, in turn. During each cycle of the machine, all the spindles advance simultaneously, and unloading and reloading of the fixtures is carried out at an idle station at the front. In Fig. 13, it should be noted, the drum and fixtures are seen from the rear of the machine. At the end of each working cycle, the spindles are withdrawn automatically, and after loading has been completed, a button must be depressed to initiate the next cycle.

Of robust design, the fixtures are bolted to the drum, and the body of each is bored to accommodate the shaft-portion of the component, and to locate it by the 42-mm. (1·6535 in.) diameter. A large latch-type clamp, pivoted on the body, has a serrated pad that contacts the outer face of the flange, and holds the machined face of the latter against a datum face on the fixture body. This clamp is secured by a single hand-operated screw. The workpiece is located angularly by four adjustable stop-screws, in lugs projecting from

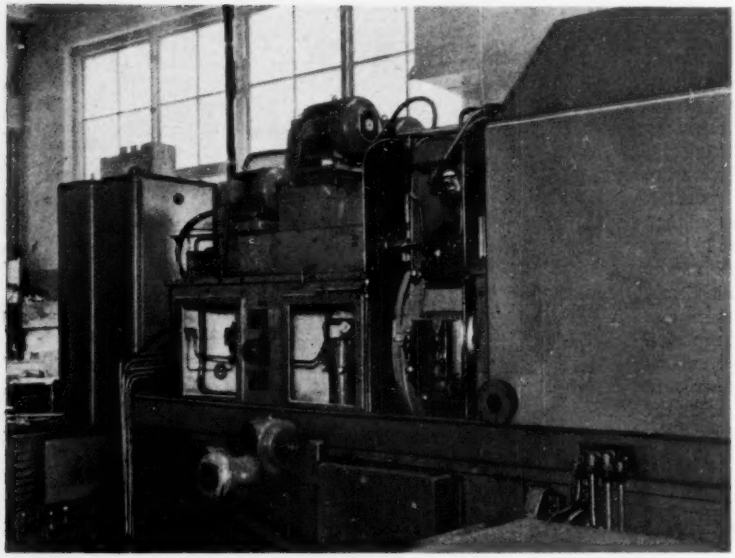


Fig. 12. A Rear View of the Large Hüller Special-purpose, Multi-spindle, Indexing Drum Machine for Drilling, Recessing and Fine-boring King-pin Bosses

the fixture body, and these screws engage the sides of the king-pin bosses. One screw, of the socket-head type, serves as a master-location, and is engaged by the machined reference-face on one of the bosses. When the fixture is adjusted initially, the end of this screw is set to the correct distance from the centre of the 40·22-mm. (1·583 in.) diameter locating bore, and the remaining screws, which have hexagonal heads, are adjusted to hold the reference face of the workpiece in contact with the master screw. Normally, when the fixture is re-set to accommodate small variations between different batches of forgings, only the hexagon-head screws are adjusted.

At the first station, 21-mm. (0·827-in.) diameter holes are drilled for half the depth of each king-pin boss, using high-speed steel drills, which are run at 230 r.p.m., and fed at a rate of 0·006 in. per rev. At the second station, two high-speed steel step-drills are employed to machine the 29·9-mm. (0·823-in.) diameter holes through the remaining depth of the bosses and to counterbore the ends of the previously-drilled holes 23·75 (0·935 in.) diameter, to the 35·3 mm. (1·390 in.) dimension indicated in Fig. 11. These drills are run at 230 r.p.m., and are fed at 0·007 in. per rev. The 24·8-mm. (0·976-in.) diameter by 1-mm. (0·039-in.) undercuts are machined at station three, with high-speed steel, circular form-tools. Each form-tool is carried by a small cross-slide, mounted on the spindle nose. The cross-slide carries a diagonally-serrated block at the rear, and this block is engaged by a correspondingly-serrated flat on the end of an axially-moving shaft, which is housed within the spindle quill.

While the spindle quill is fed towards the work, the cutter is in the central position, so that it clears the bore. When the cutter reaches the required point along the bore, the shaft within the quill is advanced, and the cutter is fed radially, by the arrangement described, at the rate of 0·0002 in. per rev. The recessing spindles are run at 270 r.p.m., and when the groove has been machined to the required depth, the motion is automatically reversed.

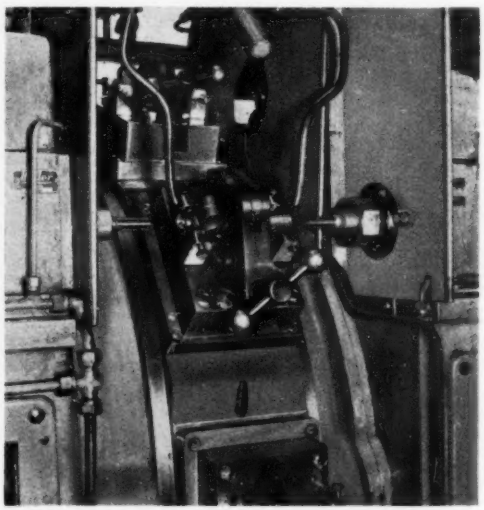


Fig. 13. Close-up View of the Indexing Drum, from Rear of the Hüller Machine, Showing the Fixtures

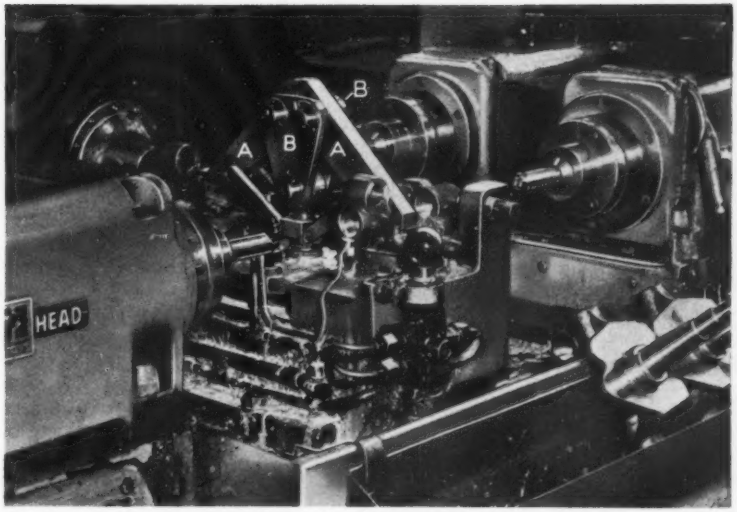


Fig. 14. At This Set-up on a Heald 4-spindle Machine, the King-pin Holes are Fine-bored in Two Components at a Time. The Fixture is Pneumatically Operated

In this way, the cutter is again centralized, in readiness for withdrawal of the spindle, and indexing of the work to the fourth station. This station is shown in Fig. 13, and there are two spindles, which are run at 1,000 r.p.m. Each spindle carries a single-point tool of Fagersta grade H.1 Seco carbide, and is fed at a rate of 0·003 in. per rev., to fine-bore the previously-machined holes to 21·800/21·930 mm. (0·858/0·863 in.) diameter.

A machined component is unloaded every 0·99 min., and this cycle-time somewhat exceeds the time required for loading and unloading. Therefore, for part of each machine-cycle, the operator removes any burrs formed on the thread during the keyway milling stage. The workpiece is held in a simple fixture, mounted on the machine adjacent to the loading station, and the thread is de-burred with the aid of a 5-land die, in a special holder. This holder has a sleeve to guide the die squarely on to the threaded portion, and is rotated by means of a crank handle. A 5-land die is used in preference to the normal 3- or 4-land type, in order to "bridge" the key-slot, and thus prevent damage to the thread.

KEYWAY BROACHING

Machining of the king-pin bores is followed by a series of simple operations, performed on Herbert ASEA 4-spindle vertical drilling machines. On one machine, the steering-arm boss is drilled, taper-drilled, taper-reamed, and spot-faced, and on a second machine, the large end of the bore is chamfered. Next, a keyway, 2 mm. (0·078 in.) wide and 2·3 mm. (0·090 in.) deep, is broached in the bore, on a Zagar type 571 hydraulic pull-broaching machine. The workpiece is loaded on to a suitably-tapered broach guide, which enters the bore, and is positioned angularly by a pair of location members which engage the 19·29 mm. (0·759 in.) diameter of the shaft portion. A chip-guard is pivoted on the workhead of the machine, and carries an air-nozzle. After each working stroke, this guard is swung down over the broach, and the air-supply is automatically turned on. The return stroke is then initiated, and, as the broach is withdrawn, it is blown free of swarf, in readiness for broaching the next workpiece. At the end of the withdrawal movement, the guard is raised, and the work is pushed off the tapered broach-guide by means of a hand-operated, lever-type stripper.

At this set-up, the broaching stroke is completed in 0·12 min., and the broach employed has 48 teeth in an effective length of 18 in. For the first 35 teeth, the rise per tooth is 0·0024 in., and for the next 9 teeth, 0·0020 in. The last four teeth are all of the same height, to provide for sizing and finishing. The Zagar broaching machine, an A.B. Arboga vertical drilling machine, and a Heald fine-boring machine, comprise another machine-group, which is tended by one operator. During the working cycle of the broaching machine, the operator removes burrs from the edges of the keyway, by lightly taper-reaming the steering arm bore on the Arboga drilling machine. The king-pin bores are then finish fine-bored, on the 4-spindle Heald machine, which is shown in Fig. 14.

AIR-OPERATED FINE-BORING FIXTURE

The fixture on the Heald machine is air-operated, and holds two components, the method of location being generally similar to that employed on the Hüller indexing drum machine. In the fine-boring

fixture, each workpiece is located with its shaft-portion vertical, and the machined reference face on one of the king-pin bosses is held against an adjustable stop-screw by a pneumatically-operated claw, which engages the opposite side of the boss. The two workpieces are thrust downwards by a linkage-system, which resembles a centrifugal governor, so that their machined flange-faces contact flat datum surfaces on the fixture. Thrust is imparted by two arms *A* which are coupled to a central, pneumatically-operated pull rod.

When the linkage is raised, the arms *A* are "folded" inwards, about their upper pivots, so that access to the work-locations for loading is unobstructed. A sliding member on the pull-down rod is urged upwards by a compression spring, and is coupled, by links, to the two clamping elements. The length of the compression spring is such that, as the clamp assembly is raised, the sliding member moves with it initially. Subsequently, the sliding member remains stationary, on top of the spring, while the arms *A* "fold" inwards under their own weight.

After the fixture has been loaded, a control valve is reset to the "clamps on" position. The pneumatically-operated claws are then advanced, and the pull-rod is moved downwards. As the clamp assembly descends, the sliding member is supported on the spring, and the arms *A* are swung outwards, until flat faces on their pivoted upper ends abut. At this stage, the outer ends of the arms are poised just above the workpieces between the king-pin bosses. Since their abutting faces prevent further movement of the arms outwards, the sliding member is thrust downwards by the links, and the supporting spring is compressed until the clamps engage the work. At their upper ends, the arms *A* are pivoted to the link-plates *B*, Fig. 14. These plates are free to swing on a pin at the top of the pull-rod, so that the clamp assembly is self-aligning.

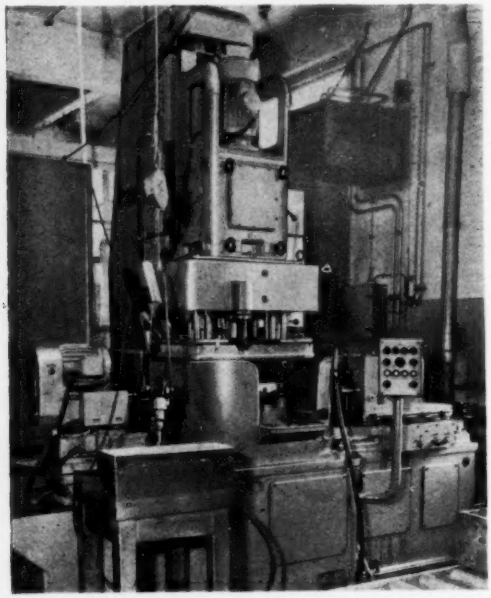


Fig. 15. This Special-purpose Hüller Multi-spindle, Indexing-table Machine is Employed for Drilling and Reaming the Flange Holes, and Drilling and Tapping the Grease-nipple Holes

With the workpieces loaded and clamped, the automatic cycle of the machine is initiated. First, the table and work are advanced rapidly to the left, and are then slowed to the cutting feed-rate of 0·0024 in. per rev. The cutter spindles are run at 1,000 r.p.m., and each carries a single-point solid tool of Fagersta grade H.1 Seco carbide, which machines one of the king-pin bores to 22·4/22·421 mm. (0·882/0·883 in.) diameter. At the end of this cutting traverse, the table is moved rapidly to the right, and again slowed to the cutting feed, for finishing the second pair of bores. When this cutting pass has been completed, the table is returned rapidly to the central position, in readiness for unloading and re-loading.

OPERATOR'S CYCLE

The operator for the group of three machines described—namely, the Zagar broaching machine, the Arboga drilling machine, and the Heald fine-borer—carries out a somewhat complex cycle of duties, which is arranged so that, for each pair of components unloaded from the fine-borer, two are broached and de-burred. The operations performed are:—(1) unload two fine-bored components from the Heald machine, re-load and initiate the automatic cycle; (2) check the bores of the components and place them in a pallet on the roller conveyor; (3) unload a broached component from the Zagar machine and engage the return motion; (4) de-burr the broached component, using the Arboga drilling machine, and transfer it to the fine-borer; (5) load and start the Zagar machine; (6) while the broaching operation is in progress, transfer a fresh component to the Zagar machine from another pallet on the roller conveyor. The sequence of duties from (3) to (6) inclusive is then repeated. By this time, the Heald machine has completed its cycle, and two de-burred components are ready, at the machine, for fine-boring. From this group of machines, one component,

which has been broached, de-burred and fine-bored, is delivered every 0·8 min.

MACHINING THE FLANGE AND GREASE-NIPPLE HOLES

Following this stage, four holes of 9·7 mm. (0·382 in.) diameter, are drilled, reamed and spot-faced in the flange, and two holes, in the king-pin bosses, are drilled, and tapped ⅛-in. American N.P.T.F. thread, for grease-nipples. These operations are performed on the hydraulically-operated Hüller special-purpose machine, seen in Fig. 15. The machine has three groups of four vertical spindles, and two opposed pairs of horizontal spindles, also a 4-station table, shown in Fig. 16, which is indexed in an anti-clockwise direction. On the vertical head, the spindle-centres are adjustable, in order to permit of machining components of either hand.

Again, the work is located by the 40·22-mm. (1·583-in.) diameter boss, the machined face of the flange, and the machined reference-face on one of the king-pin bosses. At each station, a latch-type clamp is secured to the body of the fixture by means of a large fork-bolt, at one end. The clamp can move in the vertical plane about a horizontal pin through the associated fork-bolt, and the complete clamp assembly can be swung in the horizontal plane about the pivot of the bolt.

The clamp assemblies are shown in their working positions in Fig. 16, and for loading they are swung outwards towards the front of the machine. At the right-hand side of each fixture, there is a vertical sliding member *A*, which can be raised and lowered by means of the hand-lever *B*. When the clamp is in the working position, a peg, projecting from its free end, engages a corresponding recess in the side of the member *A*. Clamping pressure is then applied by actuating the lever *B*. The clamp exerts pressure on the top of the king-pin boss. In addition, near its free end, there is a downwardly-projecting wedge-shaped finger, which engages one side of the boss and thrusts it sideways, so that the machined reference-face on the opposite side is held firmly against a register-pad *C*. This pad is mounted on the housing for the pull-down shaft *A*, and to provide for machining right- and left-hand components, there are two such register pads, and two sets of interchangeable clamps, with the locating-fingers on opposite sides.

At the end of the automatic cycle, the spindle-heads are withdrawn, the table is indexed, and the machine is stopped. A machined component is unloaded from the station at the front, a fresh component is loaded and clamped, and the automatic cycle is re-initiated. When the vertical

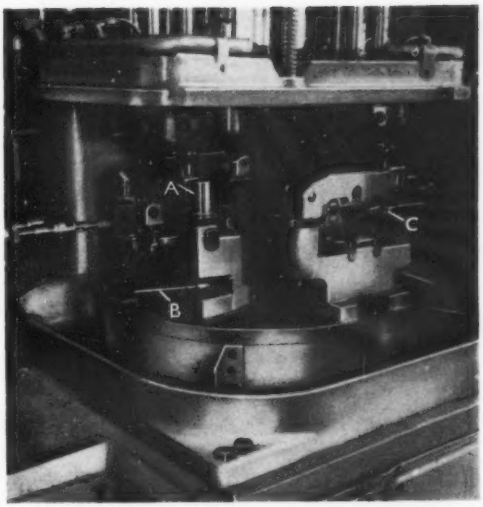


Fig. 16. Close-up View of the Machine Seen in Fig. 15 Showing the Arrangements for Holding and Locating the Work

head descends, a spring-loaded steady-plate is engaged with shouldered register-spigots on the fixtures. At the first working station, drills in the vertical spindles machine four holes of 9·4 mm. (0·370 in.) diameter, in the flange. These spindles are run at 500 r.p.m., and are fed at 0·003 in. per rev. At the same station, the grease-nipple holes are produced by 8·9-mm. (0·350-in.) diameter drills in the two horizontal spindles, which are run at 400 r.p.m., with a feed of 0·0033 in. per rev.

At the second station, the rear group of vertical spindles carry 20-mm. (0·787-in.) diameter high-speed steel, spot-facing cutters, which are run at 240 r.p.m., and fed at a rate of 0·0055 in. per rev. These cutters machine the flange face surrounding each of the 9·4-mm. (0·370-in.) holes drilled at the first station, to give a flange thickness of 6 mm. (0·236 in.). At the third station, the holes are reamed to 9·7/9·715 mm. (0·382/0·3826 in.) diameter, at a speed of 130 r.p.m., and a feed-rate of 0·001 in. per rev. Meanwhile, the second pair of horizontal spindles, which are run at 100 r.p.m., are advanced, at a rate corresponding to the thread pitch, to tap the grease-nipple holes. Finally, the work is unloaded at the fourth station, at the front of the machine, one component being delivered every 0·89 min.

During the automatic cycle of the machine, the operator de-burrs the flange and grease-nipple holes with a portable electric drill-gun, fitted with a conical cutter. This work is carried out at a bench-

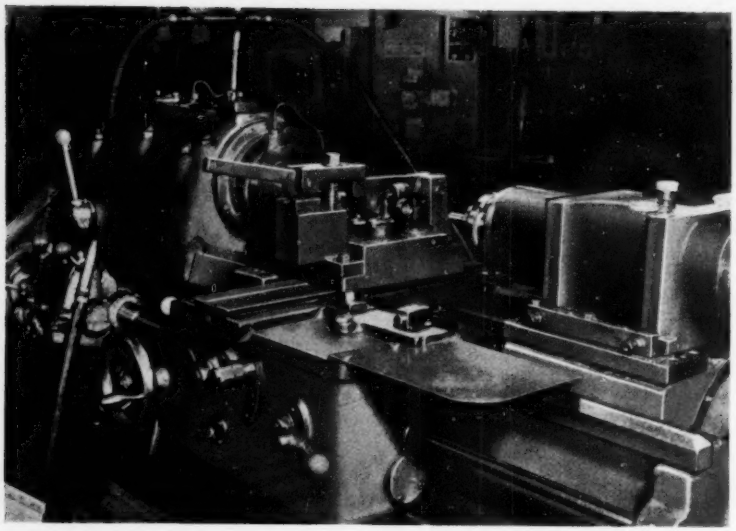


Fig. 17. This Adapted Munktell High-speed Lathe, Equipped with a Heald Fine-boring Head, is Employed for Finish-boring the Pressed-in King-pin Bushes

station, immediately to the left of the loading station of the machine in Fig. 15, where the drill-gun, and a raised wooden platform to support the work at a convenient height, may be seen. In Fig. 16, it should be noted, the machine guards, seen surrounding the working zone in Fig. 15, have been removed, to permit details of the fixtures to be observed.

FINE-BORING THE BEARING SHELLS

At the next stage, Vandervell Slevite 10 thin-wall bearing shells are pressed into the king-pin bores, using a small hydraulic press, and are then fine-bored to 19·020/19·041 mm. (0·7488/0·7496 in.) diameter, on the machine seen in Fig. 17. This machine is, basically, a Munktell high-speed lathe, fitted with a Heald fine-boring head in place of the tailstock, and a special fixture, designed to take one component, is mounted on the saddle. In this fixture, the work is located by the flange face and the 40·22-mm. (1·583-in.) diameter boss, and is secured by a cam-actuated clamp. Pivoted at the rear of the fixture there is a latch member, which contacts the flange face, between the king-pin bosses. The free end of this member projects towards the front of the machine, and is engaged by a cam-actuated clamp mounted on the front of the fixture, as seen in Fig. 17.

Before the clamp is tightened, the loaded fixture is traversed to the left, so that a pilot portion on the cutter bar fitted to the headstock spindle enters the hole to be fine-bored, and in this way the work is located angularly. The clamp is then tightened, the machine is started, and the operator engages the saddle feed. When the bore at one side has been machined to the full depth by the cutter bar in the headstock spindle, the advance of the saddle is stopped automatically. Thereupon, the operator traverses the saddle manually, in the opposite direction, and when the workpiece approaches the Heald fine-boring head, engages the feed action in the reverse direction. When the second bore has been machined to full depth, the motion is stopped automatically, the saddle is returned to the central position, and the fixture is unloaded and re-loaded. Both cutter-bars are run at 3,000 r.p.m., and carry solid tool-bits of Fagersta grade H.1 Seco carbide. A feed-rate of 0·0023 in. per rev. is employed in both directions. At this set-up, approximately 2·5 mm. (0·098 in.) of metal is removed from the diameter of each bore, in a floor-to-floor time of 1·26 min. per component.

The operator is responsible for pressing-in the bushes and tending the fine-boring machine. A bush is pressed into each bore of a stub-axle, while the left- and right-hand bores of the previously-bushed workpiece are being finished.

Some further examples of machining operations on the stub-axles and the associated steering knuckle support fittings, and some of the methods employed in their assembly, will be discussed in a later article.

PRODUCTION OF TIME RECORDERS AND SWITCHES in the U.K. during October of last year had a total value of £207,000, and units to the value of £59,000 were exported. The average monthly value of units produced in 1956 was £176,000, and units to the value of £32,000 per month were exported.

Production and Assembly of Strips for Mikrokator Movements

An earlier article in MACHINERY, 92/658—21/3/58, was concerned with the "twisted-strip" amplifying principle of the CEJ Mikrokator, and some typical applications in the range of instruments made by Aktiebolaget C. E. Johansson, Eskilstuna, Sweden. Attention was also drawn to some of the methods and equipment employed by the company for producing the very fine glass tube pointers for these instruments. Here, the production of the twisted strips, and some of the stages in the assembly of the instruments, are considered, also some examples of equipment used in other departments of the factory.

As already mentioned, the twisted strips for the amplifying mechanisms are of phosphor bronze, 0·12 mm. (0·0048 in.) and 0·06 mm. (0·0024 in.) wide, and from 0·0025 mm. (0·0001 in.) to 0·0045 mm. (0·00018 in.) thick. The two thicknesses indicated represent the extremes, and the former is used for special instruments. Strip of 0·0045 mm. (0·00018 in.) thickness is used for instruments which are of average sensitivity. This material is cold-rolled from strip stock, 0·1 mm. (0·004 in.) thick, on the small mill shown in Fig. 1. Driven by a variable-speed D.C. motor, with a built-in reduction-gear, the mill has a pair of main rolls of relatively large diameter, which are employed to back-up two very small working rolls.

Rolls of this small size are employed in order to build-up the high load per unit area necessary, and the diameter of the rolls is varied according to the reduction required at each pass. Normally, several passes are necessary, during which the rolls are driven at a slow speed. Each of the small rolls is supported in a special carrier-plate, which is profiled on one edge, to form a seating. The width of the seating is slightly less than the diameter of the roll, and the plates are mounted horizontally, in such a manner that the axes of the small rolls lie in the same plane as those of large rolls. A recess in each of the adjacent faces of the plates affords clearance for the passage of the strip, and the small rolls are kept in position in their seatings by the direction of rotation of the main rolls.

The speed of the driving motor can be adjusted by means of a variable resistance, and the strip is drawn from a spool. On the exit side of the rolls, the reduced strip is kept under light tension, by means of a cord, pulley and weight. It is sometimes desirable to anneal the reduced strip continuously, as it emerges from the rolls, and for this purpose the head A, Fig. 1, is provided. Mounted on a pivot on the base of the rolling mill, so that it can be swung downwards, clear of the work, when not required, this head incorporates a strip-type resistance heating element. When the head is swung upwards, into the working position, the reduced strip slides over the heating element, and is thereby continuously heated. Normally, however, this device is not employed, and all rolling is carried out without intermediate annealing.

This rolling mill, it may be noted, is also employed for producing the 0·001-mm. (0·00004-in.) duralumin foil strip used for the "visible" portions of the pointers, and the thickness of both types of reduced strip is checked with Mikrokator comparators. Two of these instruments are provided near the rolling machine, so that a close check may be kept, and that employed for measuring the foil has an exceptionally low contact pressure. Such instruments, it may be noted, can be supplied, with

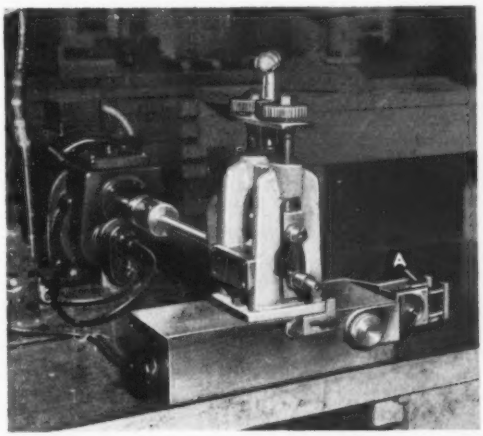


Fig. 1. This Small Machine is Employed for Rolling the Thin Phosphor-bronze Strip, from which the Twisted Strips are Produced

a measuring pressure as low as 0·3 grammes (0·011 oz.). When the metal has been reduced to the thickness required, it is divided into strips of the appropriate width on a miniature roll-type slitting machine. The "rolls" are interleaving steel discs, of a thickness corresponding to the strip-width required, with the edges ground accurately square, and sharp-cornered.

FORMING THE TWISTS

As the bronze strips are sheared to width, they coil themselves loosely in the spaces between the slitting-discs, whence they are later carefully removed. They are then cut off into oversize lengths, in readiness for forming the twists. As indicated in the earlier article, the portions of each strip on either side of the centre, are twisted, with permanent set, in opposite directions, so that when the strip is stretched lengthwise, the central portion, to which the pointer is attached, turns. Twisting in this manner is carried out with the aid of small fixtures, of the type shown in use in Fig. 2.

Each fixture incorporates a pair of parallel rods, with fixed cross-members at each end. At intermediate positions there are two more cross-members, one of which is arranged to slide on the rods, and is connected to the fixed member at one end by a light tension-spring. This sliding member, and the fixed member at the opposite end, are each equipped with a small flat clamp, secured by a single screw. Situated intermediately between these two cross-members, the fourth comprises two portions, secured to each other by screws, at a fixed distance apart. Mounted in the space between them, there is a split circular clamp, the two halves of which are held together by an encircling spring clip, retained in a circumferential groove. Integral with one-half of the circular clamp, there is a pair of journal spigots, one of which projects axially on each side. These journals, which are drilled axially for clearance purposes, rotate in bearing-bores in the associated cross-members.

The fixture is loaded by threading a length of strip through the split clamp, for which purpose the halves are sprung apart by inserting a tapered key between them, at the periphery. Each end of the strip is then secured by means of the small flat clamps already mentioned, care being taken to ensure that there is no initial twist of the strip. Light tension is applied to the strip by means of the spring, which is anchored to the fixed cross-member by a screw and a milled nut. Adjustment of the tension is effected by rotating the nut. When the strip has been clamped and tensioned,

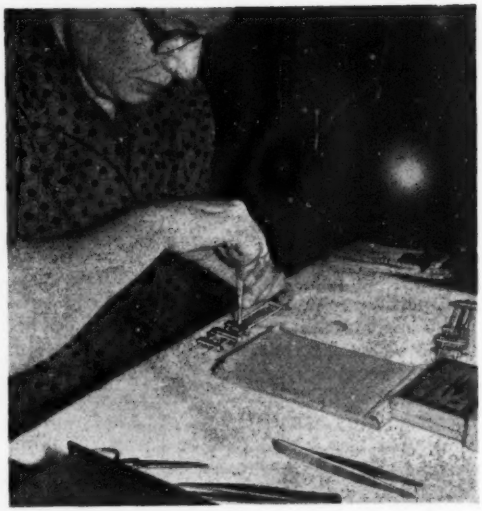


Fig. 2. Here, one of the Highly-skilled Operators is Seen Twisting the Strip Used in Mikrokator Movements, with the Aid of a Small Fixture

as described, the key is removed from the split clamp, so that it closes on to the middle of the strip. The split clamp is then rotated through a predetermined number of turns, and is locked by means of a clamping screw. With the twist maintained in this manner, the assembly is loaded into a heat-treatment oven, at a fairly low temperature. This treatment serves to relieve the stresses set-up by twisting, so that when the strip is later removed from the fixture it does not tend to untwist.

ASSEMBLY

The design of the amplifying mechanisms is such that they do not lend themselves readily to the use of tooling and locating fixtures for assembly purposes, and it is necessary, therefore, to rely on skilled operators. Stage assembly is not employed, each girl operator being responsible for building and setting the complete movement. The assembly procedure for a typical Mikrokator is as follows. The the die-cast frame and shank are received already assembled, complete with measuring-stem, spring knee, and adjustable leaf-spring support, and, to facilitate the subsequent operations, the partly completed unit is set-up on a comparator stand, as shown in Fig. 3.

Operations on the movement begin with the twisted strip, the ends of which are pinned to

the spring knee, and the adjustable leaf-spring support. Next, the cross-member carrying the oil-damping sleeve is secured to the arms of the frame by a screw at each end. This sleeve, it may be noted, has a longitudinal slit, which enables it to be passed over the twisted strip. The dial, with the pointer-stops already assembled to it, is next secured to the frame, and the instrument is then ready for the attachment of the pointer. For this purpose, it is removed from the comparator stand, and laid flat on the bench, as in Fig. 4. A small wire cradle is placed on the dial, near the centre of the scale, and serves to maintain the clearance of the pointer while the opposite end is secured to the twisted strip.

Before it is attached to the strip, the butt end of the pointer is clipped off to length, with special tweezers. A small daub of a thermoplastic adhesive is melted on to the twisted strip at the centre with the aid of the special electrically-heated tool seen in use in Fig. 4. This tool comprises an insulating handle, and a loop of resistance-heater wire, formed into a tight hairpin bend. The pointer is placed in position in the wire cradle, and is secured to the twisted strip by a light touch of the heating tool.

Subsequently, the leaf-spring support is adjusted to bring the pointer central on the scale,

Fig. 3. To Facilitate Assembly of the Amplifying Mechanism, the Work is Set-up on a Comparator Stand, as Here Shown

Fig. 4. Assembling the Pointer. A Special Thermoplastic Adhesive is Employed, and is Applied with the Aid of an Electrically-heated Tool

with the instrument held vertically, and a small blob of the adhesive is melted on to the butt end of the pointer, to serve as a counterweight. Balance of the pointer is then checked by holding the instrument horizontally, first on one side, and then on the other, and small amounts of adhesive are added to the counterweight, until the same reading is obtained for all positions. When the balance has been corrected, the instrument is set-up on the comparator stand, and, with the aid of slip-gauges, the leaf-spring support is adjusted so that the movement of the pointer corresponds exactly to a given displacement of the contact stem.

For this purpose, two slip-gauges are used, the difference in thickness of which corresponds to the scale-range of the instrument. As earlier mentioned, the movement of the pointer is proportional to the elongation of the twisted strip, and this elongation, in turn, depends upon the applied tension. It is necessary, therefore, in calibrating the instrument, to adjust the initial tension, and the working tension range, so that the amplified movements of the pointer correspond accurately to the scale divisions. In the leaf-spring support, provision is made for this adjustment by varying the effective length, and consequently the stiffness, of the spring. In addition, a "rocker" mounting arrangement is employed, whereby the initial tension may be adjusted.

The outer end of the arm on the die cast frame, which carries the leaf-spring support, takes the

form of an obtuse-angled, vee-shaped fulcrum, with its pivotal edge horizontal. The vertical leaf-spring, which is of bronze, is sandwiched between a pair of brass clamping-plates secured to the end of the arm by two screws. These screws straddle the fulcrum, so that by slacking-off one, and tightening the other, the assembly can be tilted in either direction. The clamping-plates are slotted, so that they may be raised or lowered in order to vary the effective length of the spring.

At the upper end, the inner clamping-plate is slotted horizontally over the greater part of its width, to form a horizontal spring arm, and a screw passes vertically through a clearance hole in the outer end of the arm, into a tapped hole in the body of the plate. This screw, by controlling the effective height of the upper edge of the arm, provides for fine adjustment. The initial tension is first set, by means of the rocker-screws, so that the pointer of the instrument just rests against the left-hand stop on the dial, when the contact-stem is free. The instrument is then adjusted on the comparator-stand so that, when the stem is in contact with the thinner of the two slip-gauges, the pointer just moves on to the scale.

Thereafter, the amplitude of the pointer-movement, as compared with the known difference in thickness of the slip-gauges, is ascertained, and any necessary adjustments are made in the manner described. Once the setting has been approximately established, the rocker screws are locked, and the final correction is obtained by means of the fine adjusting screw in the top of the inner clamping-plate. Finally, the two halves of the housing are assembled round the movement.

In certain of the instruments, a zero adjusting screw is provided, which passes through the housing, and bears on the outer end of the frame arm that carries the leaf-spring support. When this screw is tightened, the frame-arm is very slightly deflected, elastically, so that the initial tension of the twisted strip is altered. This adjustment will give a maximum pointer deflection of approximately six scale-divisions. A pressure limiting device is incorporated, so that the frame-arm cannot be permanently strained by the application of excessive pressure.

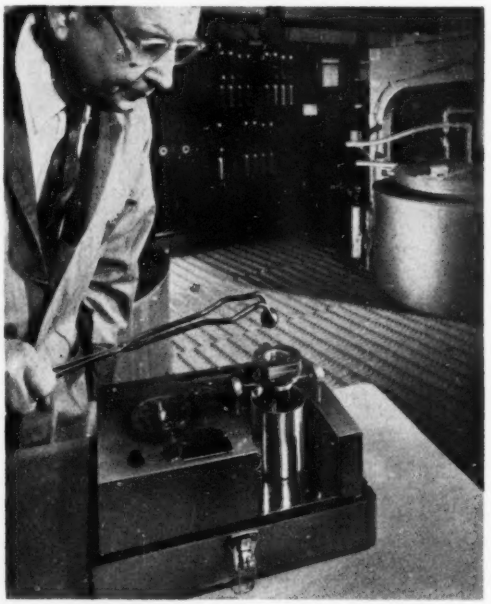
Device for Measuring the Effectiveness of Quenching Media

The magnetic "Quenchometer" shown in the figure, which has been designed by The General Motors Process Development Section, Detroit, Mich., U.S.A., permits of determining the cooling or quenching effectiveness of oils, water, brines, and other liquids employed in the heat-treatment of steel.

As is well known, a magnetic material heated beyond the Curie point loses its magnetism, and regains it when it is cooled below this point. A 1-in. ball of high-purity nickel is used in the Quenchometer test because it does not scale or crack as a result of repeated heating and cooling. Nickel has a 670-deg. F. Curie point, and prior to a test on a quenching fluid the ball is heated to 1,600 deg. F., so that it becomes essentially non-magnetic.

It is then dropped into a small cage suspended in a cup of the quenching medium under test. When the ball cools to the point at which it regains its magnetism, it is attracted toward a magnet adjacent to the container, carrying the cage with it.

A circuit accurately measures the time from the instant the ball drops into the cage until it is attracted to the magnet. This interval is a measure of the cooling capacity of the quenching fluid that is being investigated.



A Nickel Ball, Heated to 1,600 deg. F., is Dropped into the Quenchometer. The Effectiveness of the Quenching Medium is Measured by the Time Required for the Ball to Regain its Magnetism

New Production Equipment

Dronsfield's No. 504 Roll Turning and Grooving Lathe

The No. 504 lathe shown in Fig. 1 has recently been built by Dronsfield Brothers, Ltd., Atlas Works, Oldham, for performing a variety of operations, at a single setting of the work, involved in the production and re-conditioning of cylinders and rolls from 2 to 66 in. diameter. It is made in three sizes, with capacities for handling rolls with face widths from 37 to 72, from 37 to 96, and up to 120 in.

Operations that can be carried out on the lathe include turning, parting-off headers from large cylinders, "ending out," facing to length, and grooving. Equipment is provided for mounting on the tool slide which enables saw tooth wire to be wound and caulked on grooved rolls for use in the textile industry. Upon completion of this operation, grinding and burnishing of the teeth on the wire can be carried out, at separate passes of the saddle, by a motor-driven 2-spindle unit, which is also mounted on the tool slide. This unit can be indexed in the horizontal plane for bringing the grinding wheel or the burnishing disc to the working position, and a single belt is provided so that the drive from the motor can be transmitted to only one spindle at a time.

Of robust construction, the lathe enables heavy cuts to be taken with tungsten carbide tools at high work speeds and feed rates. Drive is taken from a 15-h.p. 2-speed motor, through 2-speed lever-operated and pick-off gears in the headstock, and finally to the hollow Meehanite spindle by a worm and wormwheel. Twenty-four spindle speeds from 5 to 160 r.p.m. are thus obtainable. A close-up view of the headstock from the rear is given in Fig. 2. The headstock gears run in an oil bath, and the shafts on which they are mounted, also the spindle, rotate in anti-friction bearings. A 3-jaw self-centring chuck and a 36-in. diameter faceplate are provided. There are T-slots in the body of the chuck, as well as in the faceplate, to take work driving pins.

From the headstock, drive is transmitted by a splined shaft and bevel gears to the feed gear box, and thence to the saddle by a screw mounted between the vee and flat bedways. A total of 112 sliding feeds ranging from 0·017 to 0·8 in. per spindle rev., are provided by lever-operated change-speed gearing and pick-off gears. The saddle can be reversed automatically at any point in its travel, and a screw-cutting dial is provided for use when grooving operations are performed at several passes of the tool.

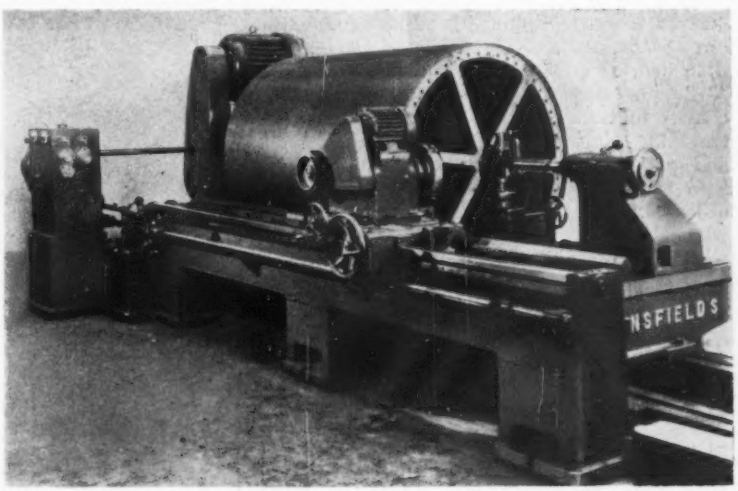


Fig. 1. Dronsfield's No. 504 Roll Turning and Grooving Lathe

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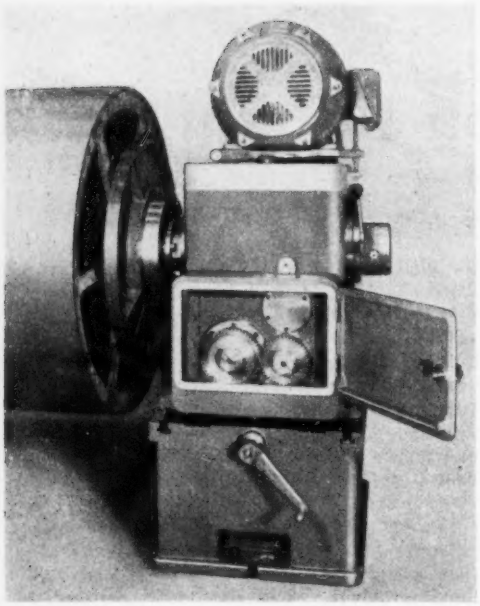


Fig. 2. Close-up View from the Rear of the Headstock on the Lathe Shown in Fig. 1

The tailstock has a built-in, ball-bearing mounted, rotating centre, and is carried on a base which can be adjusted longitudinally on separate guideways at the rear of the bed to accommodate work of different lengths. Both the headstock and tailstock can be adjusted towards and away from the tool slide bed, to suit cylinders of different diameters. A 3-point steady, with roller-bearing mounted contact rollers, is available for attachment to the tool slide, and is intended for use when turning and grooving is to be performed on cylinders from 2 to 10 in. diameter. For supporting the shafts of large-diameter cylinders, there is a second steady which is adjustably-mounted on a separate base carried on the guideways at the rear of the bed.

Jaco Coolant Spray Unit

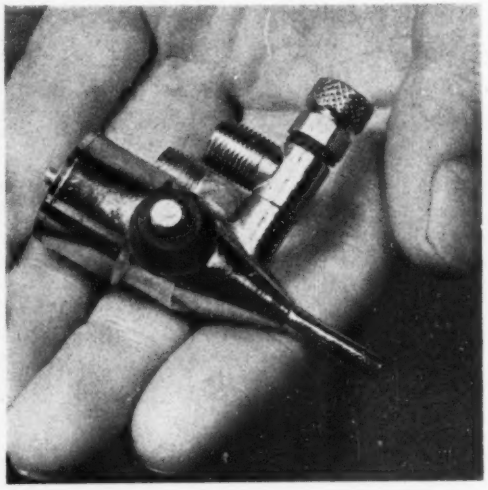
Shown in the illustration is the recently-introduced Jaco coolant spray unit marketed by the Stanley Jevons Tool Co., Avon Street, Birmingham.

In use, coolant is normally delivered to the unit by gravity, through a hose, and is then directed on to the work, in mist form, by compressed air. Separate threaded connecting pieces are provided for the attachment of pipes for the compressed air and fluid supplies, which are controlled independently by needle valves.

For setting purposes, both valves are tightened on to their seatings, and the compressed air supply is then turned on. As a result, a central piston is moved towards the rear of the unit. Next, the valve for the air supply, which is mounted in a back plate, is turned through about two revolutions and is held in its open position by a lock nut. Finally, the needle valve for the fluid supply is adjusted, by turning a knurled knob, until coolant is discharged from the nozzle in the form of barely-visible mist.

Although originally developed for use in connection with high-speed cutting operations, the unit may also be employed for the delivery of coolant for milling, turning, drilling, tapping, broaching and abrasive belt grinding, for example, at fairly slow speeds. It is stated that for most applications the coolant consumption is only about ½ to 1 pint per day. The unit will handle most non-corrosive fluids in addition to coolants, and may be used, if desired, for applying rust inhibitors to workpieces while machining is in progress, and liquids for suppressing dust resulting from the cutting of cast iron.

Of compact design, the unit can be mounted in a variety of different positions, and a stud is attached to the body for fixing purposes. It can be operated from compressed air supplies of 50 to 150 lb. per sq. in. pressure, and no pressure



Jaco Coolant Spray Unit

regulator is needed. If required, several units can be mutually connected, and controlled simultaneously by a single valve for the compressed air supply, which can be arranged for operation by hand or by a solenoid, cam, or pedal. The unit can be arranged to deliver fluid continuously, or intermittently at rates up to 70 cycles per min.

A tank of ½ gal. capacity for coolant, and flexible hose for compressed air and fluid supplies, can be provided with the unit.

A range of cutting fluids and lubricants has been developed by Isaac Bentley & Co., Ltd., Trafford Park, Manchester, 17, for use with the Jaco unit, and they are distributed by the Stanley Jevons Tool Co. These products comprise clear soluble and straight cutting fluids known as Vincut Soluble Spray and Vincut Straight Spray; Presssees drawing lubricant; Vinoleo bandsaw lubricant; and Vincut lubricant for abrasive belt grinding.

Fig. 2. La Précision Mécanique Electronic Comparator with Signal Light Unit

La Précision Mécanique Gauging Equipment

The French firm La Précision Mécanique, Paris, include among their activities the production of a comprehensive range of gauging equipment, certain types of which are now to be made by their representatives in this country, Engineering & Scientific Equipment, Ltd., 33 Minster Road, London, N.W.2. Initially, single and multi-dimensional gauging equipment incorporating electronic gauge heads, which are available in 10 types, will be produced. These gauge heads, while of high precision, with a setting accuracy of 0·00004 in., are stated to be relatively inexpensive, and they can readily be mounted in simple fixtures for inspecting parts produced in small quantities, or in semi-automatic or fully-automatic gauging equipment for handling large batches of workpieces. In addition, they can be employed for the remote control of machine tools, presses, and hardness testers, for example. Fig. 1 shows an arrangement of three gauge heads in a special fixture, for inspecting a bearing shell, and in Fig. 2 is seen a standard form of electronic comparator. The associated control unit incorporates light signals to indicate whether the part being measured is acceptable, oversize, or undersize.

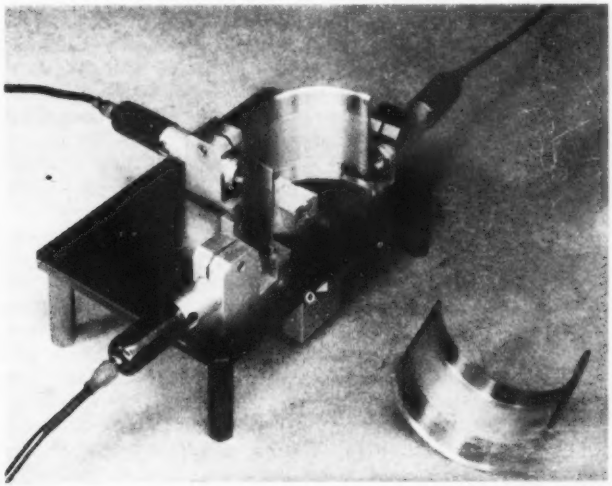


Fig. 1. Three La Précision Mécanique Electronic Gauge Heads are Incorporated in this Fixture for Inspecting a Bearing Shell

The wide range of control equipment available for use in conjunction with these electronic gauge heads includes coloured light and audible signal units, counters for production

and statistical control, automatic feed mechanisms for the components, and automatic sorting mechanisms for segregrating the parts according to the result of the inspection.

New Attachments for the Thiel Universal Milling Machine

In the accompanying illustrations are shown some recent additions to the range of attachments for the German-built Thiel 158 universal toolroom milling machine.

A new boring and milling head is intended for mounting on the end of the adjustable overarm, as shown in Fig. 1, and can be swivelled through 180 deg. from the vertical position. It is driven from the main horizontal cutter spindle, and the 12 spindle speeds available may range from 60 to 1,200 or from 90 to 1,800 r.p.m. The spindle is bored No. 5 Morse taper and will take collets up to 1 in. capacity. The spindle head can be traversed vertically on adjustable flat guideways through a maximum distance of 6⅝ in. Three rates of power feed, namely 0·0012, 0·0024 and 0·0048 in. per rev. are available, and can be

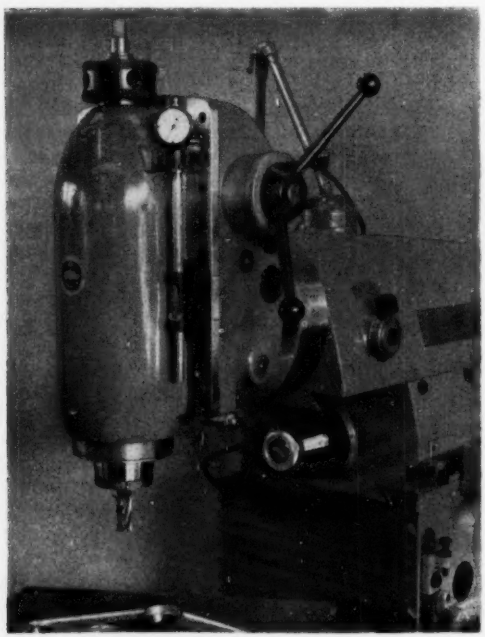


Fig. 1. The New Boring and Milling Head for the Thiel 158 Toolroom Milling Machine

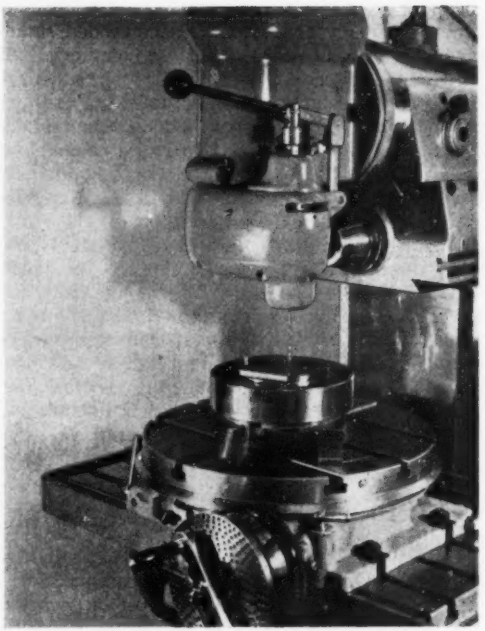


Fig. 2. Close-up View Showing the New High-speed Drilling Attachment Mounted on the Milling and Drilling Head

engaged, as required, with the spindle running, selection being made by means of a knob on the side of the head. An adjustable vernier scale, and a dial indicator which can be set with the aid of slip gauges, are provided to facilitate milling and boring to predetermined depths. By adjustment of the overarm, a maximum distance of 27½ in. can be obtained between the spindle axis and the column of the machine. The attachment weighs 121 lb.

Another new item is a high-speed drilling attachment, which can be used in conjunction with the new boring head, or with the standard milling and drilling head, as illustrated in Fig. 2. Weighing 22 lb., this attachment provides spindle speeds from 1,720 to 5,000 r.p.m. The spindle will take collets up to $\frac{7}{32}$ in. capacity, and has an axial travel of $1\frac{9}{16}$ in., by hand.

A horizontal-spindle milling attachment has also been developed, which can readily be secured to the lower end of the boring head or the milling and drilling head. This attachment can be swivelled through 360 deg. about a vertical axis, and may be used for rack milling operations, for

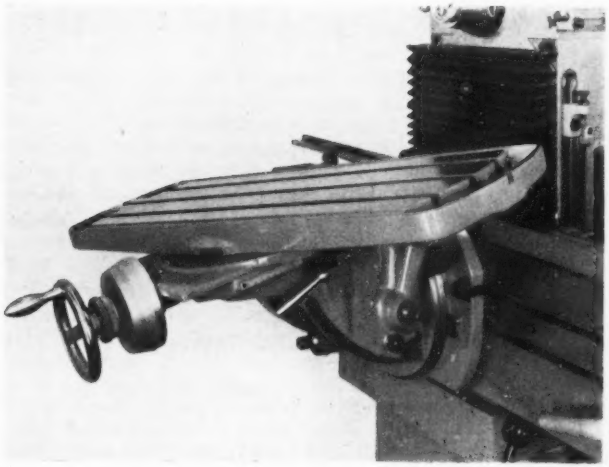


Fig. 3. The New Universal Work Table for the Thiel Toolroom Milling Machine

example. The spindle is bored No. 2 Morse taper and will accommodate collets with capacities ranging up to ⅞ in.

The recently-introduced table shown in Fig. 3 has a T-slotted working surface of 31½ by 10⅝ in. It can be swivelled in each direction through a maximum of 30 deg. in the horizontal plane, and 180 deg. in the vertical plane. In addition, the table can be tilted through 30 deg. on each side of the horizontal position, and has a cross traverse of 5¾ in., by hand, settings being made with reference to a vernier scale and a micrometer drum. Adjustments for angle are made by pinions and gear segments, and scales, which give readings to 6 sec. of arc, are provided for accurate setting.

The new spiral milling attachment has a centre height of 3¾ in., and will accommodate lengths up to 14¾ in. It can be swivelled through angles up to 45 deg. for milling tapered parts, and enables leads from ¼ to 240 in. to be cut.

The spindle of the dividing head is bored No. 5 Morse taper, and will take collets up to 1 in. capacity.

Rockwell Machine Tool Co., Ltd., Welsh Harp, Edgware Road, London, N.W.2, are the selling agents in this country for Thiel toolroom milling machines.

Maxam "Woodpecker" Drill Unit

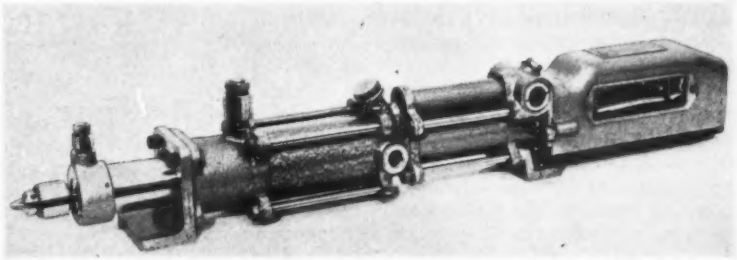
The step-feed drill unit shown in the accompanying illustration, which has rapid approach, controlled feed rate, and automatic step-feed action has been developed recently by the Maxam Division of the Climax Rock Drill and Engineering Works, Ltd., Carn Brea, Cornwall.

Two standard units can be supplied, known as types MX588 and MX589, with drilling strokes of 2 in. and 4 in., respectively. A drill chuck of 0 to ½-in. capacity is fitted, and the standard chuck speed is 2,400 r.p.m. In addition, units with speeds of 540, 970, 4,000, and 6,000 r.p.m. are available.

The drilling stroke is pneumatically operated, and the steplessly-variable forward feed rate is governed by a hydraulic control. Drilling can be carried out to a pre-set depth, against a positive stop, and when the required depth has been reached, the spindle will automatically withdraw rapidly to its starting position.

Various movements of step-feed can be obtained by means of an adjustment screw within the rear housing of the unit, and during the relief stroke the air supply to the drill spindle motor is interrupted, thus reducing the consumption of air. Rotation of the spindle is then resumed automatically at the beginning of each rapid approach stroke. Alternatively, the drill spindle can be set to rotate slowly during the relieving stroke, to facilitate the clearance of swarf.

The air supply to the unit is controlled by a

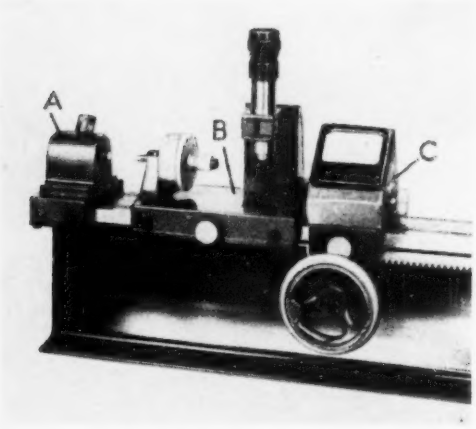


Maxam "Woodpecker" Drill Unit

Maxam 4-way double-solenoid operated reversing valve, and this valve can be supplied with coils suitable for most standard A.C. or D.C. voltages

Hommel Length-measuring Machine

The newly-developed precision length-measuring machine shown in the accompanying illustration is made by Hommelwerke, Mannheim, Germany, and is marketed in this country by Rubert & Co. Ltd., Chapel Street, Stockport Road, Levenshulme, Manchester, 19. This machine can be used for



Hommel Length-measuring Machine

external and internal measurement, and the measuring operation is based on a comparison of the length of the sample with either a scale, or a combination of slip-gauges. The saddle *A* is fixed to the bed of the machine, and the anvil which projects from each of its end faces can be moved axially, in either direction, against springs. An electrical indicator, carried on the saddle *C*, registers the degree of compression of these springs, when measuring is taking place, thus enabling a series of measurements to be made with a consistent end pressure.

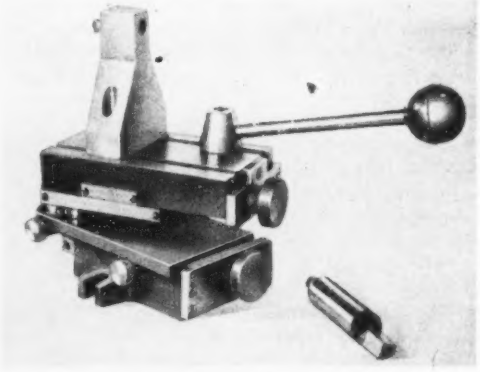
A slide *B* carries a micrometer, with a large-diameter drum graduated in 0·0001-in. divisions, also a microscope of 12½× magnification. This microscope has its own illuminating unit, and is used for setting the slide *B* relative to graduations on a scale fixed to the upper surface of the bed slideways. Adjustment of the slide *B* is effected by means of the rack and pinion-operated saddle *C*, to which it is coupled by a precision adjusting screw. With the saddle *C* clamped, this screw is used to adjust the position of the micrometer head slide relative to the anvil in the saddle *A*.

The machine is made with a wide range of bed-lengths, for maximum measurements from 80 in. to 400 in. Accessories available include: bearing saddles, for supporting long workpieces; adjustable mounting-feet for use when the machine is set-up directly on the floor; slip gauges and holders; special saddles for use when measuring U-shaped centre distance gauges; and insulated pincers and gloves for handling the slip gauges and workpieces.

Skilform Compound Radius Forming Tool

Skil Engineers, Ltd., Chell Street, Longsight, Manchester, have recently developed the Skilform compound radius forming tool, shown in the figure, for general workshop use. Of simple design, the tool enables accurate convex or concave radii up to 1½ in. to be produced. It can be employed for dressing abrasive wheels to arcs and angles for form grinding, and for grinding radii on tool-bits and form tools. Basically, it is a compound table with fine screw adjustment to both slides, and it can be used as an indexing fixture for milling, drilling and grinding.

A pivot connects the upper and lower dovetail slides, the former carrying a 5½- by 3-in. T-slotted worktable for holding components or tools. A vertical hole fitted with a hardened bush is provided in the top slide to receive a radius setting gauge. By means of a rule and vernier, the displacement of the top slide from a zero position may be read directly to 0·001 in., and at the zero setting the gauge hole in the top slide is accur-



Skilform Compound Radius Forming Tool

ately positioned coincident with the pivot pin.

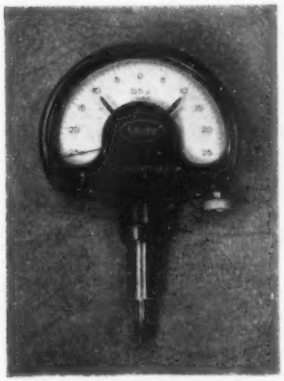
Provision is made for locking the slides and pivot by means of knurled head screws, and angular settings are read directly on a graduated ring. The tool base is slotted to receive a key whereby it is aligned with the machine table. Equipment supplied with the tool includes a diamond holder and diamond for wheel dressing, a block and clamp for holding tool-bits and small components, an operating handle which can be fixed in various positions, a radius-setting gauge, and a clip-on cover for protecting the slideways from abrasive dust.

For dressing a grinding wheel, the diamond is set to the required radius, and is traversed by swinging the top slide around the pivot. The diamond may be fed towards the wheel by traversing the lower slide.

When grinding tool-bits and small components, the gauge is inserted in the hole and the required radius is set on the rule. The tool is then adjusted so that the gauge just touches the wheel, by movement of the lower slide. The component may be clamped directly to the top slide. Alternatively, a tool-bit or other small part may be secured in the tool-holder provided. Feed is applied by operating the lower slide screw, while the radius is generated by swivelling the top slide.

Carl Mahr Supramess Comparator

Lerche Machine Tools, Ltd., Oakwellgate, Gateshead-on-Tyne, are the selling agents in this country for the latest Carl Mahr Supramess comparator, which is shown in the accompanying illustration. The range of the scale is ±0·025 mm., and the scale is graduated in increments of 0·0005 mm. Scale divisions are 0·9 mm. apart, and the accuracy over the full range is ±0·00025 mm. The free stroke of the plunger is 3 mm. These figures apply to the Metric type No. 1003 S. A similar instrument, No. 1103 SZ, has English graduations and gives readings to 0·00002 in., with a range of ±0·0010 in.

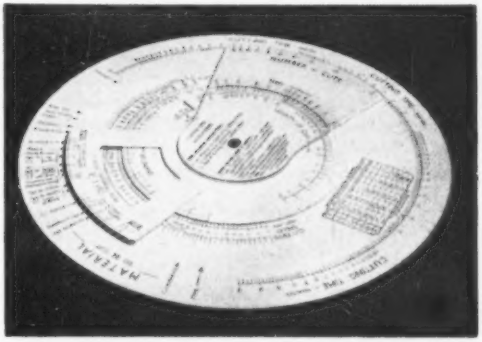


Carl Mahr Supramess Comparator

The comparator has a constant measuring pressure of 100 grammes, and friction in the mechanism is minimized by the use of jewels or miniature ball bearings. Tolerance markers facilitate reading, and there is a fine adjustment for the indicator hand over the full range. A jewel point is provided on the measuring plunger, and a standard flexible wire lifter can be fitted.

Fearns-Mear Calculator for Machining Times

Fearns, Mear & Co., Ltd., 43 St. Helens Road, Almondbury, Huddersfield, have recently placed on the market the calculator here shown, to facilitate estimating cycle times for operations performed on centre, turret and capstan lathes and boring mills.



Fearns-Mear Calculator for Machining Times

Of the circular slide rule type, the calculator is made from transparent and white plastics material, and has scales of different colours. It may be used for calculating cycle times for turning diameters from ⅛ to 80 in., and lengths from $\frac{3}{16}$ to 200 in.

Two rotatable segments are provided on one side which can be set in accordance with the type of workpiece material, type of cutting tool, diameter and length to be turned, the number of cuts to be taken and the cutting speeds and feeds to be employed, and the cycle time for the cutting operation is then indicated by a scale near the periphery. A disc on the opposite side can be set with reference to scales for estimating the times required for setting-up, loading the work, manipulating the cutting tools, and gauging.

Calculators for estimating cycle times for other machining operations are being developed.

A New Single-operation Precision Blanking Process

Although sheet-metal components of a wide variety of shapes and sizes are effectively produced by blanking on power presses, difficulties are experienced when the cut edges must have a high-quality finish and the shape must be held to very close limits. The Swiss tool-making firm of Heinrich Schmid, in association with the manufacturers of SMG hydraulic presses, have now developed a technique, known as the precision blanking process, whereby components can be stamped-out with smooth, sheared edges, at right angles to the die face.

This process can be applied to the production of components, such as pawls, levers, slides, racks, gears, and cams, to close limits of accuracy, and with high standards of surface finish. Some details of the process and equipment have now been made available by the agents in this country, who are Pearson Panke, Ltd., 1-3 Hale Grove Gardens, London, N.W.7.

In ordinary blanking operations on a power press, the material is actually cut for only part of its thickness. As soon as the limiting shear stress is exceeded, the material tears or breaks. As a result, the so-called sheared edge of the component has a poor surface-finish, which is unsuitable for the smooth transmission of movement, unless some finishing operation is subsequently carried out.

The finishing processes that can be applied include milling and grinding, or one of the special techniques such as shaving on a second press, on which an over-size blanked component is clamped and then "shaved" by means of a reciprocating die. The die is reciprocated, as it is moved downwards towards the component, at a rate of 1,200 to 1,500 times per min., and a thin shaving of metal is removed from all round the form. The ejection of this scrap material from the tool frequently presents difficulties and, in any event, two tools (one for blanking and one for shaving) and two operations are required. In general, such finishing operations substantially increase the production costs of the components, and even if they are carried out with the help of very accurate gauges and tools, the relationships between the shaved and unshaved parts of the pressings—and, in particular, between the shaved form and any holes produced at the blanking stage—cannot be guaranteed to close limits.

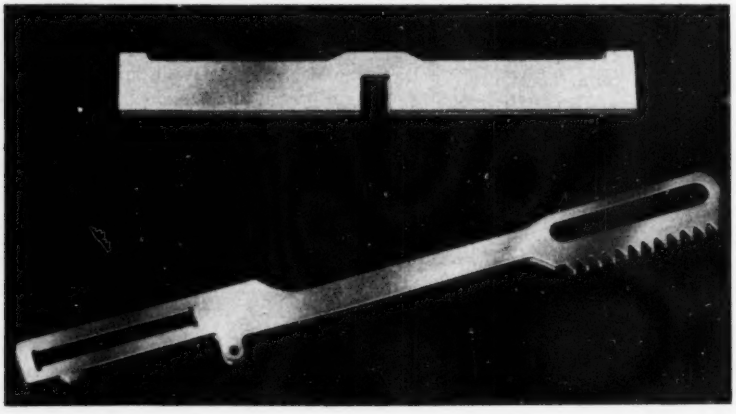


Fig. 1. These Two Components Have Been Produced from Good Quality, Medium Temper Mild Steel by the Precision Blanking Process. The Upper Component is Made from 0·113-in.-thick Strip, and the Lower, which is a Rack for a Calculating Machine, from 0·060-in. Thick Material

THE PRECISION BLANKING PROCESS

The new precision blanking process is claimed to offer important advantages, as regards both cost and accuracy. In this process, the material is held firmly during the cutting of the blank, so that it is only sheared on the desired line, and will not tear at whatever point the structure is weakest.

Examples of components produced by precision blanking are shown in Fig. 1, and these are finished as far as the profiles are concerned. The sheared

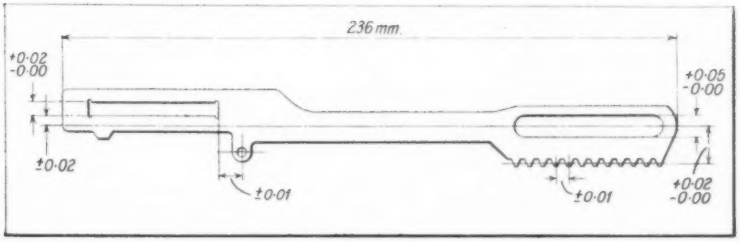


Fig. 2. Details of the Rack Component in Fig. 1 are Here Shown. All Dimensions are Given in Millimetres

edge has a surface comparable with that obtained by precision machining or grinding, and the form is accurate within 0·0005 in. or less. The accuracy of the component, of course, still depends on the standard of toolmaking, and cannot exceed that of the tool with which it is produced.

It is well known that, normally, a rounded edge is produced all round the form on the face of the component that enters the die first, whereas a burr is thrown up on the other face. This rounding-off is considerably reduced when the precision blanking process is used.

It is impossible to blank components with sharp corners in the plan form by this process, and all corners must be rounded, unless a poor finish in these areas can be tolerated. The radius at any corner should be not less than 0·020 in. for material up to 0·078 in. thick, and from 0·030 to 0·040 in. for material from 0·078 to 0·157 in. thick.

The precision blanking process can be employed for material ranging in thickness from 0·060 to 0·315 in. As in conventional blanking, it is not possible to avoid burrs with the new process, but the burrs produced can readily be removed by such treatments as tumbling or electrolytic polishing.

TYPICAL WORKPIECES

One of the components now being produced by precision blanking is the gear rack seen at the top in Fig. 1, also in Fig. 2, and it is stated that the production costs for this part are now only one fiftieth of those involved when it was produced by conventional means. Clearly, the advantages derived from the application of the new process will not always be as great as in this example, but it is claimed that the savings in costs will always be substantial, since at least one operation stage is eliminated.

Not all materials are suitable for precision blanking, but those to which it can be effectively applied include steel, of 0·4 to 0·6 per cent carbon content, aluminium and its alloys, bronze, copper and brass.

A minimum output of 600 to 800 pieces per hour can be achieved. This output is very much less than the production rates of conventional blanking presses, but compares more favourably with those obtainable with the finishing processes which are eliminated by the new method.

PRECISION BLANKING EQUIPMENT

Precision blanking tools require a high standard of tool making. As already indicated, the accuracy with which the tools are made is of paramount importance, and the tools also have to withstand higher pressures than do normal blanking tools. The dies are either ground or spark-machined.

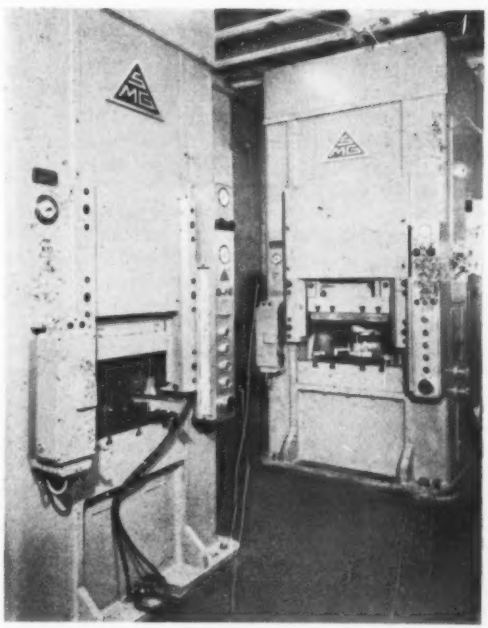


Fig. 3. One of the Range of SMG Hydraulic Presses Used for the Precision Blanking Process which has been Developed by Heinrich Schmid in Conjunction with the Press Builders

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Special SMG hydraulic presses employed for precision blanking are shown in Fig. 3, and are of very rigid construction. Particular attention has been paid to the design and construction to ensure that the table is very rigid, and that the ram guides do not distort or deflect under load. Mechanical presses cannot be used for this technique, nor is an ordinary hydraulic press suitable. The press has to be arranged to provide a special single-, double- or treble-action, and, for certain applications, it should be possible to combine the precision blanking process with forming, drawing or extrusion operations, provided that the latter are not severe.

SMG hydraulic presses for precision blanking are made in four standard sizes, which are capable of exerting maximum total pressures of 60, 100, 150 and 250 tons. On all four presses, the maximum distance between the table and ram is 15¾ in., the closing-up speed is 15¾ in. per sec., the maximum stroke is 11⅛ in., and the driving motor is of 25 h.p. On the two smaller presses, the tables measure approximately 25½ by 20 in.; on the 150-ton press, 25½ in. by 21⅝ in.; and on the largest machine, 27½ by 31½ in. The ram faces on the two smaller presses measure 19⅛ in. square on the 150-ton press, 21⅝ in. square; and on the largest unit, 31½ in. square. Depending on the pressure applied, the maximum working speeds of the rams on the presses range from 3 to 1·22 in. per sec.; 1·81 to 0·75 in. per sec.; 1·22 to 0·51 per sec.; and 0·71 to 0·28 in. per sec. On the latest presses there is provision for mounting roll-feeds and similar strip-handling units.

Precision blanking equipment can be used by anyone experienced in ordinary blanking operations, but good experienced tool makers are required for maintenance of the tools.

VISQUEEN POLYTHENE FILM, which is made by British Visqueen, Ltd., Six Hills Way, Stevenage, Herts, a subsidiary of Imperial Chemical Industries, Ltd., is claimed to be very suitable for the protective packing of machinery, spares and components. It can be supplied in sheet form in widths from ½ in. to 12 ft., and in tubular form, from 1 in. to 6 ft., and is transparent, flexible, tough, chemically inert, and impervious to water.

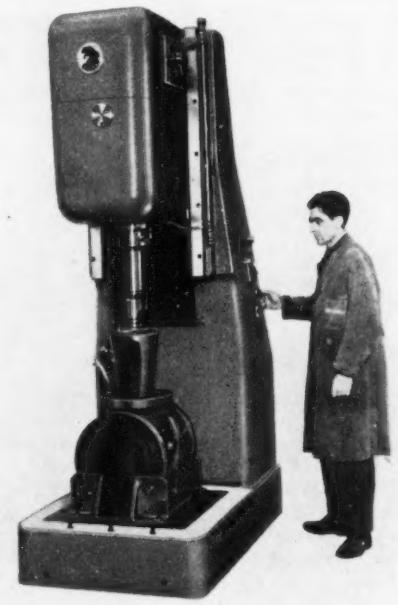
Machinery may be completely enveloped in Visqueen within packing cases and all joints and openings sealed. If air is evacuated prior to final sealing, the moisture content is greatly reduced. The vacuum is gradually lost over a period of time, but the transmission rate for moisture is very low. Residual moisture and the effects of infiltration can be eliminated by the use of silica gel.

Beer Lapping Machine for Large Cocks and Valves

The German-built Beer machine shown in the figure has recently been supplied to The Esso Petroleum Co., Ltd., for lapping large cocks and valves.

Of fabricated steel construction, the frame houses a special pump for the continuous delivery of lapping compound to the work. The valve body is secured to the T-slotted work tabie, and the taper plug is held by a floating mandrel attached to the spindle. At the beginning of the working cycle, which is controlled by a timer, the plug is lowered into engagement with the bore of the body, and contact pressure between the surfaces to be lapped is maintained by a spring. Overlapping clockwise and anti-clockwise movements are then imparted to the plug so that the action is similar to that of hand lapping. At the end of the lapping period, a signal is transmitted by the timer to stop the machine.

Rockwell Machine Tool Co., Ltd., Welsh Harp, Edgware Road, London, N.W.2, are the selling agents in this country for Beer machines.



Beer Lapping Machine for Large Cocks and Valves

Die Casting Supplement

Nozzle and Sprue Design for Gooseneck Die Casting Machines

By H. K. and L. C. BARTON

Whereas in a cold-chamber machine a measured quantity of molten metal is transported from the injection cylinder to the die cavity at each shot, a gooseneck machine operates by simple displacement, and, at the completion of the plunger stroke, the metal in the gooseneck is continuous with that in the sprue channel, runner channels and die cavity. In most gooseneck machines there is a short detachable tubular element, or nozzle, interposed between the gooseneck and the die. The principal purpose of the nozzle is to permit a closer control of the metal temperature, but it also serves to space out the die platen from the metal-melting furnace, so that heat transfer is reduced.

The function of the nozzle in temperature control is not always fully understood. It is not, primarily, the temperature at which the metal enters the die that is affected, because the metal passes so quickly through the relatively short nozzle channel that there is little chance for the stream to take heat from, or lose heat to, the nozzle wall. What is more important is the temperature at the rear end of the sprue channel at the completion of injection, and it is this temperature that can be controlled by varying that of the nozzle.

The actual sprue-channel is invariably tapered so that the sprue can be withdrawn easily from the stationary half as the die opens, but nozzle channels have a great variety of forms. Since die casters frequently have replacement nozzles cast to their own patterns, instead of obtaining standard replacements from the machine manufacturers, they tend to modify the internal shape according to their own ideas concerning the functions of a nozzle. For example, it is quite common for a nozzle to be cast with a thin wall and a large internal chamber, as indicated in Fig. 1, with the object of presenting an increased surface to the metal. It is then assumed that, with the nozzle held at a constant temperature, the metal will give up some of its heat if too hot, and take up heat if too cool, during its transit through the nozzle.

Another line of thought leads to the use of a thin-walled nozzle, with a re-entrant portion at the outlet end, as in Fig. 2. Such a nozzle is intended to be operated with a lower external heat input than normal, the metal being prevented from solidifying at the outlet by the transfer of

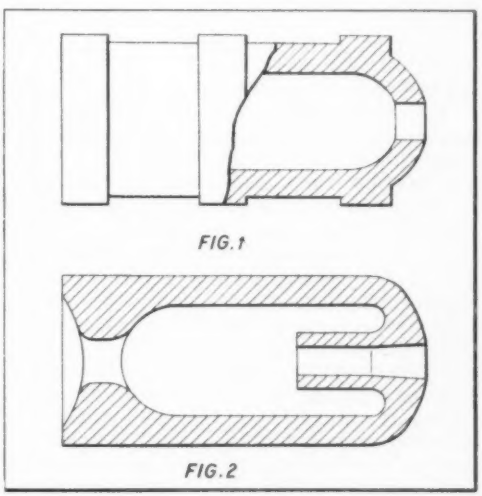


Fig. 1. Die Casting Machine Nozzle with Large Internal Cavity

Fig. 2. The Metal Surrounding the Re-entrant Portion of this Nozzle Prevents Chilling

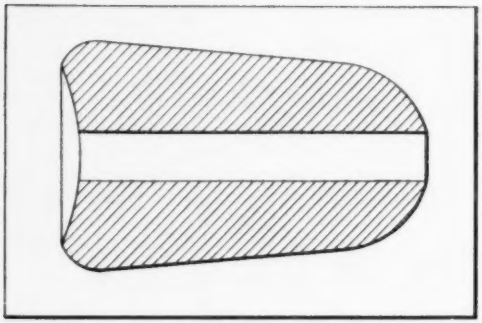


Fig. 3. This Simple Form of Nozzle is to be Preferred to More Elaborate Types

heat from the molten metal surrounding the re-entrant orifice. The effect of all such variations is to increase the iron surface exposed to the molten metal, with the result that the Fe content of the casting is raised. An increase in iron contamination is especially liable to occur if, as sometimes happens, the design is such that a pocket of molten metal is trapped as the nozzle empties on the return stroke of the plunger.

Although the iron content is not likely to reach an objectionable level, it is preferable to present as small a surface of iron to the melt as possible, throughout the injection system. Since the nozzle is so often a zone of local overheating, moreover, it is particularly unwise to increase the internal surface in this way.

It is also desirable to minimize the outer surface of the nozzle and so reduce radiation losses, because, with a gas-heated nozzle (and this type is still by far the most widely used), a general heat loss from the whole surface is made good by increasing the local temperature at the point where the flame plays on the surface. It is mainly at such overheated areas that action between the melt and the iron parts of the furnace occurs.

From the point of view of reducing radiation, the ideal nozzle would be of spherical shape, but this form would be impracticable for operation, and the most usual shape is a truncated cone with a spherical cap, as seen in Fig. 3. It is important that the nozzle should be sufficiently massive to form an effective heat reservoir, so that its temperature does not fluctuate greatly between one phase and another of the casting cycle. A thin-walled nozzle quickly gives up heat to the metal as soon as flow is arrested at the end of the plunger stroke, and is therefore ineffective for preventing solidification from progressing beyond the junction of sprue and nozzle, should the dwell period, with the plunger down, be protracted.

The temperature of the nozzle, also the temperature of the die block in the vicinity of the sprue channel, must in practice be held in a rather critical balance. As heat is being lost to the system in a variety of ways, the duration of the casting cycle, or at least that part of it during which the plunger is down, greatly affects the attainment of that balance. If solidification proceeds too far before the die is opened, the sprue-metal is likely to remain in the fixed die member, as in Fig. 4, because it is anchored by solidified metal at the outlet end of the nozzle. If, on the other hand, the sprue has not completely solidified when the die opens, the tip is likely to fracture and to remain loose in the sprue-channel, as depicted in Fig. 5.

CAUSES OF NOZZLE DRIP

At high operating speeds, a further difficulty sometimes arises. If the die is opened very quickly after the plunger has been drawn up, metal may surge out of the nozzle and drip down the face of the die. This surging results from the movement of metal in the gooseneck. As the plunger moves upwards, metal is drawn past it into the metal well.

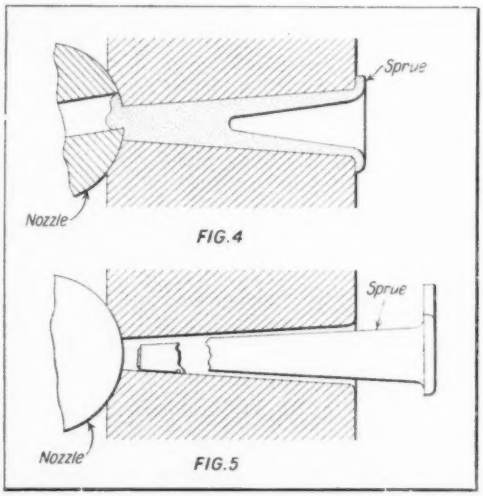


Fig. 4. If Solidification Occurs at the Junction of the Nozzle and Sprue-hole, the Sprue-metal is Likely to Remain Wedged in the Die, as Shown Fig. 5. Fracture of the Sprue-metal Occurs when the Die is Opened Before Chilling has Progressed Sufficiently

When the plunger clears the ports, the metal can, of course, pass in quite freely, and is, in fact, drawn in at speed during the last half-inch or so of plunger travel. As plunger movement stops, therefore, a pressure pulse is transmitted through the body of the melt, which is intensified in the narrowing channel of the gooseneck and nozzle.

If, therefore, the die is opened as soon as the plunger is retracted, a small quantity of metal may be forced through the nozzle into the sprue channel. With even a brief pause, before the die is opened, however, the surge occurs while the orifice is still blocked with the sprue-metal, and dribbling does not occur. It should be noted, too, that the effect is most marked when there is some axial play in the plunger assembly. The plunger may then rise momentarily above its normal "up" position, and drop back a fraction of an inch. A drop of $\frac{1}{16}$ in., with a 2½-in. diameter plunger, displaces more than 0·25 cu. in. If this displacement follows immediately after the pressure surge, an appreciable proportion of that volume may be expelled from the nozzle, despite the fact that the ports to the metal-well are open.

Occasionally, dribbling from the nozzle results from another set of circumstances. As soon as the die members part, and the sprue-metal is loosened in the sprue orifice, air can enter and the level of the metal in the gooseneck falls. Surplus metal passes freely out at the ports, and if this movement should be in phase with the outward movement that follows the inward pulse described above, the level in the gooseneck falls below the general metal level. This fall is corrected by a new influx through the ports, beneath the stationary plunger.

Again, there is over-compensation and the metal rises high in the narrow gooseneck channel. In normal circumstances, however, it has not sufficient momentum to pass through the nozzle into the sprue-hole. On the other hand, if the initial unlocking of the die is followed by a short dwell, and the die is then opened very quickly, and if, in addition, the sprue is long and has minimum taper, it may happen that the pumping effect of the withdrawal of the sprue, coinciding with the upward movement of the metal toward the nozzle, causes a small quantity of metal to dribble into the sprue-orifice. A slight discharge, produced in this manner, may be more dangerous than a pronounced dribble, because in the circumstances outlined the distributor pin is likely to be long and slender. There is a likelihood, therefore, that the tip of the pin may contact solidified metal in the sprue-hole and force it back (Fig. 6) as the die closes. The resultant wedging action may then bend the end of the pin.

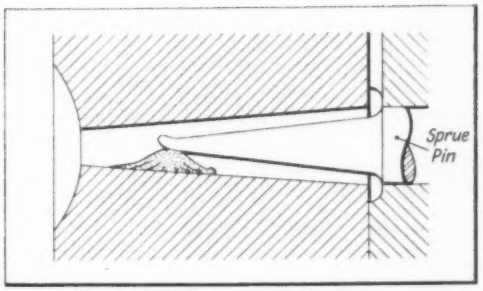


Fig. 6. Drips in the Sprue-hole may Solidify and Damage the Sprue Pin when the Die is Closed

Of the other faults mentioned above, which may result from poor temperature control, fracture of the sprue-metal during the opening stroke of the die is the commoner, and can always be attributed primarily to unsatisfactory sprue design. Fracture will only occur in sections that are barely below the solidus temperature, and, for this reason, the point of breakage is normally some little distance ahead of the tip of the distributor pin. If the pin is long and slender, however, the tip may become heated above the melting point of the alloy. Fracture is then most likely to occur at a point behind the tip, and the exact location depends on the thermal gradient along the sprue.

REMOVING BROKEN SPRUES

If the broken-off portion slides toward the wider end of the sprue-hole it can be hooked out, but usually (since this particular trouble is most likely to occur with slender sprues of small taper) it remains inaccessible. If only a small portion of the sprue has broken away, the die can be carefully closed and a shot made, the newly injected metal rushing past, and partially melting, the obstruction. If a fracture has occurred behind the sprue-tip, this procedure cannot be followed, because, as the die is closed, the sprue-metal is thrust forward and blocks the orifice completely. Consequently, with the sprue-tip re-impaled on the pin, the die should be opened again slowly in the hope of extracting it.

If this expedient fails, it is necessary to use a tool resembling a large gimlet, with a tapered thread approximating to the taper of the sprue-pin. When the sprue-hole cannot be cleared in this manner, the obstruction must be treated in the same may as that resulting from a nozzle freeze-up, which, as already noted, causes the sprue-metal to be retained in the fixed member as the

die opens. It is then necessary to break the connection between the die and the nozzle, and to remove the latter, so that the sprue-metal can be tapped loose and knocked out. However expeditiously this operation is carried out, an unwarranted loss of productive time is involved, since, by proper design, hold-ups from this cause can be virtually eliminated.

THE NEED FOR ADEQUATE SPRUE SIZE

The most important requirement, and one which is much neglected at the present time, is to scale up the size of the sprue to match increases in die and machine capacity. Large dies need large sprues, not only to permit rapid filling of the cavities, but also to ensure that the heat transferred from the molten metal can be adequately dissipated. In addition—and this is perhaps the most immediately critical requirement—large sprue-channels make it possible to use nozzles of adequate outlet diameter. The outlet size is limited by the diameter at the small end of the taper, and the former should always be substantially smaller, since, in machines with the normal arrangement of an upward-tilted nozzle, the sprue and nozzle meet obliquely, as in Fig. 4, and, as there indicated, do not register correctly if the sprue-channel is of small diameter. There appears to be no advantage at all in chambering out the nozzle. Heavy walls are desirable for maintaining even heat, and a plain parallel bore is all that it required. If the gooseneck channel greatly exceeds in diameter the hole normally required at the nozzle outlet, however, the nozzle may be tapered or stepped. The important dimension is the diameter of the outlet. On the larger machines, employed for producing components of, say, 6 to 10 lb. weight in zinc, the small end of the sprue should not be less than ¾ in., and the nozzle outlet size may then be of the order of ⅝ in.

NOZZLE HEATING

Even with a nozzle that is intrinsically satisfactory, freeze-ups may readily occur if heating is ineffectively applied. Quite often, nozzle jets are so placed as to heat the die rather than the nozzle itself, and it is, indeed, rather difficult to heat a nozzle evenly with a single flame. Reasonably good results can be obtained if a curved deflector is provided at the back of the platen on the far side of the nozzle, but it is preferable to arrange for two small burners to play on the nozzle some 2 in. back from the die seating. A ring burner, with several small jets pointing inwards and back at the nozzle, does not appear to offer any appreciable advantage as compared with a pair of well-directed jets, set below, one on each side.

The front end of the nozzle should be maintained at a temperature between 400 and 410 deg. C., but it is difficult to make an accurate check. If the temperature is measured with a rod-type pyrometer, inserted through the sprue orifice into the nozzle, the reading is almost certain to be low, a value of perhaps 360 deg. C. being obtained, when it is clear, from the operation of the machine, that the interior surface temperature must be appreciably higher. In practice, therefore, the heat input to the nozzle must be determined empirically, and should be just sufficient to prevent freeze-up when the dwell period of the cycle is increased by two or three seconds beyond the normal. With timed-cycle machines, a sufficient margin is thus provided to take care of normal fluctuations in metal temperature.

On manually-controlled machines there is still a possibility that random extensions of the dwell period may occasionally cause freezing-up, and this risk should not be made an excuse for increasing the injection temperature or the nozzle temperature. To increase the metal temperature—even into the 415 to 425 deg. C. range—is highly undesirable once a die has been proved for a lower temperature, and increased heating of the nozzle only has the effect, in the long run, of slowing the cycle.

The main advantage of automatic cycle-timing, indeed, is not so much that it ensures an unvarying time for each phase of the cycle, but that it consequently necessitates very close control of the thermal variables. Ultimately, the mechanical properties of the casting depend upon the thermal conditions under which it is produced, and not directly upon cycle timing, but in practice only the latter can assure thermal uniformity.

DWELL TIMING WITH MANUALLY-CONTROLLED MACHINES

Since the dwell period after injection, and before the die is opened, is the most critical, it is of advantage, for manually-controlled machines, to provide some sort of time standard to which the operator may adhere. The simplest method is to include a signal light in a variable-delay circuit, the lamp being illuminated as soon as the plunger lever is operated. After the pre-determined dwell period, the lamp is extinguished, as a signal for the operator to open the die. It is true that, with this arrangement, the injection phase is not divided into a period during which pressure is exerted upon the metal, and a subsequent dwell after the plunger has been retracted. On the whole, however, it is

less important to control this division than to ensure that the opening stroke of the die occurs at a fixed time after the down-stroke of the plunger.

It is seldom, in practice, that the length of the dwell is determined by the heaviest section of the actual casting. Investigation of steady-running tools almost invariably indicates that the solidification of the sprue is the determining factor in establishing the point in the cycle at which the die opens. With a correctly-designed die, the sprue should solidify a moment before the casting has cooled to a safe ejection temperature, but it is often found that a casting can be ejected without distortion when the operation cycle rate is such that the sprue-metal drips from the pin. It will be evident that, in these circumstances, there is an appreciable and quite avoidable loss of production solely on account of ineffective sprue design.

At a sufficiently low production speed, of course, any form of sprue suffices. The gradual increase in production speeds over the years, however, has been accompanied by a progressive narrowing of choice in sprue design. The faster a die is to operate, the less scope is there for departure from the sprue form that provides for optimum thermal diffusion. In practice, however, sprue forms have sometimes been retained long after they have become an impediment to efficient production.

DEVELOPMENT IN SPRUE DESIGN

The most inefficient type of sprue, so far as rate of heat loss is concerned, is that depicted in Fig. 7. It is completely solid—at least in theory—since there is no distributor pin, and is anchored to the moving die member by the stub formed in front of the ejector pin, the cavity being counterbored without draft, or even slightly undercut. Despite this precaution, the sprue-hole must be well tapered and highly polished to ensure easy stripping. Today, solid sprues are only occasionally employed, mainly in tools where massive moving cores prevent the use of distributor-pins, but formerly they were not uncommon in general die casting. On manually-operated machines, with low effective injection pressure, they had the advantage of offering little resistance to the entry of the metal, and the excessive time required for solidification was accepted as the price to be paid for filling intricate cavities.

Originally, a distributor pin was provided not so much for the purpose of withdrawing heat from the sprue-metal than as a method of anchoring the sprue firmly to the ejector half as the die opened, since solid sprues were particularly unreliable in this respect. By providing a pin on which the sprue contracted, adequate anchorage was ensured. A tapered form, as seen in Fig. 8, facilitated final withdrawal, but notches were often filed when sprues began to stick in the fixed die.

At low production speeds, a solid distributor pin, of the form illustrated, operated quite satisfactorily, as the flow of heat along the shank was adequate to chill the inner surface of the sprue-metal. The shank projected several inches from the back of the die, and was coupled to a rack-and-pinion arrangement, whereby the pin was drawn back out of the sprue, prior to ejection of the casting. When fixed sprue-pins replaced the retractable type, the diffusion of heat from the tapered portion was much impaired, and it was found necessary to provide pins of larger diameter with less acute taper.

A corresponding enlargement of the sprue-orifice was then necessary, as indicated in Fig. 9, and sprues of proportions similar to that illustrated proved effective for a wide range of casting sizes

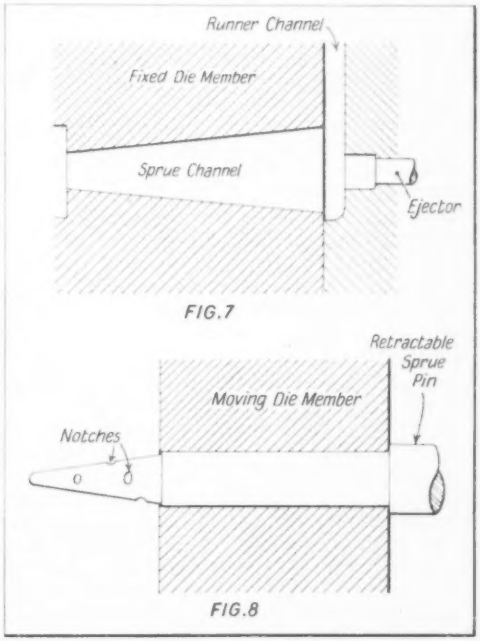


Fig. 7. Typical Layout with a Solid Sprue, Once Very Common in European Practice

Fig. 8. Retractable Sprue-pins, Developed from the Older Sprue-cutting Rod, were Widely Used on Manual Die Casting Machines

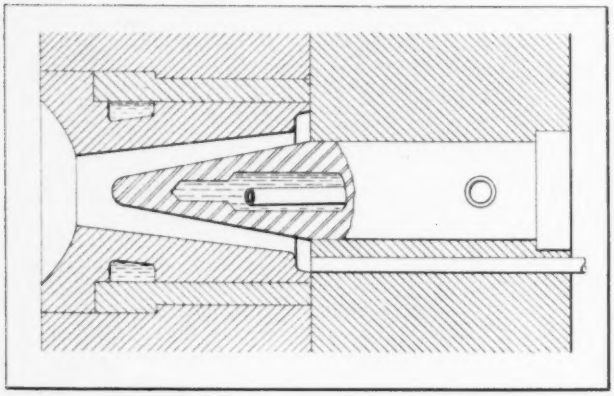


Fig. 9. Typical Water-cooled Sprue-bush and Sprue-pin

and production speeds. This effectiveness, however, was due less to any inherent virtues than to the fact that the larger sprue-pins were of sufficient diameter to permit of water-cooling. It may be noted that water-cooling of the exterior of the sprue by means of a collar let into either the platen or the die-block was already well established practice. Area for area, however, internal cooling is much more effective.

When a water-cooled collar, such as that shown in Fig. 9, is provided, a thin shell of metal chills quickly, but, in so doing, it contracts and loses its original intimate contact with the wall. Further heat transfer is thus impeded, and the sprue-pin must thereafter carry away a disproportionate share of the heat left in the sprue-metal. It will be evident, however, that contraction improves the contact beween the die casting alloy and the pin, so that the flow of heat into the latter is only limited by the temperature rise. In effect, therefore, the flow is determined by the rate at which heat can be conducted back along the shank and transferred to the surrounding, cooler, die-block.

Unless of very large diameter, a solid pin cannot give an adequate rate of heat transfer, for it operates under particularly unfavourable conditions. During the injection phase, when the molten metal is passing through the sprue, the walls of the channel and the tapered surface of the pin are both subjected to severe heating. The collar can well dissipate this heat, but the tip of the pin is likely to reach a temperature at least equal to that of the injected metal by the end of the stroke. Before any heat can be transferred from the die casting alloy, therefore, the pin itself must cool down, and the more acute the taper, the longer is the period required for cooling.

WATER-COOLING FOR SPRUE-PINS

There is a great improvement in the rate of sprue-chilling when the sprue-pin itself is water-cooled, and with the wider adoption of machines arranged for power closing, provision of water-cooled sprue-pins became almost universal. Two types of pins were widely accepted. In one design (Fig. 9), the water entered through a central tube within a larger bore, and returned along the outside of the tube. The other type of pin had a thin partition which divided the bore into two semi-cylindrical portions. The second design offered less impediment to flow, but with the first, the water was impelled well forward into the recess formed within the taper of the pin, where rapid cooling is most necessary.

As the inner wall of the pin must be held at a temperature a little below boiling point, the temperature rise of the cooling water, and therefore the quantity of heat abstracted from the pin for a given rate of flow, is limited. To improve transfer it is necessary both to increase the internal surface area of the water-chamber and the water-flow, and this can only be achieved by providing a still larger pin. Consequently, there has been a tendency, of late years, to employ large-diameter sprues of very pronounced taper, or stepped sprues. Both arrangements, which are illustrated in Fig. 10 and 11, respectively, permit the use of large distributor pins so that the very substantial heat inputs associated with the injection of several pounds of molten zinc at each shot can be effectively dissipated.

STANDARD PINS AND BUSHES

Because of the severe conditions of service, sprue-pins and water-cooled sprue-bushes fitted to large dies operating at high speeds are subject to much more rapid deterioration from heat checking than are other parts of the tool, and it is important that they should be constructed so as to be readily replaceable. Moreover, like other consumable parts, they should, so far as possible, be standardized as regards materials and design. Standardization of pins presents no difficulties, since they can be set into the die for a fixed distance without regard to block thickness. Many firms, however, still design a water-cooled bush

as part of the die, adjusting the overall length according to the thickness of the block.

Only in exceptional circumstances is this course justified, and a range of three bush lengths meets the requirements of most normal dies. For example, a single standard bush can be used with die-blocks varying in thickness from, say, 3 in. to 5 in., the rear faces of the thicker blocks being relieved sufficiently to accommodate the nozzle, as shown in Fig. 10. Two other sizes of bush, suffice for blocks in the 5- to 7-in. and 7- to 9-in. ranges. Some companies employ bushes which differ only in overall length, but where this practice is followed, the sprues formed in the longer bushes have longer solid portions. On the whole, it is preferable to scale up the sprue-orifice and the mating pin, so that the latter projects further into a deeper bush.

The stepped design of bush is intended to meet the difficulties that arise owing to the slow rate at which the solid portion of the sprue chills. Since the distance to which the sprue-pin can enter the bush is limited by the effectiveness with which the tip can be cooled, there is always, in practice, an appreciable solid section in the sprue for a deep die. As this section cannot be chilled by the pin, it is a logical course to reduce the diameter, and, consequently, the cross-sectional area, to a minimum. With this arrangement, a slender solid sprue, chilled by the collar, is united to a broad hollow sprue, chilled by the water-cooled pin.

This type of sprue is most successful for multi-cavity dies with radial runners disposed uniformly around the sprue, so that the flow of metal is the same in all directions. It is less effective when the metal flowing around the pin must pass into a single runner on one side of it, and, in these circumstances, a better flow is obtained by grinding a flat down one side of the sprue-pin. Quicker cavity filling is thus obtained, and less heat is lost to the sprue-pin as the metal is injected. This point is of some importance, since the metal in the furnace must be held at a slightly higher temperature. If much heat is lost as the metal enters the die, the faster injection takes place, the lower is the heat loss during transit.

IMPORTANCE OF UNRESTRICTED FLOW

It is essential that flow should not be constricted at any point before the metal reaches the gate, and as sprues increase in size and length it becomes more difficult to avoid such constriction. As the main cooling effect of the sprue-bush is at the rear, heavy sections at the large end of the sprue must be chilled principally by the pin. The general practice, therefore, is to reduce the thickness of the sprue wall (but not the area of the annular cross-section) towards the base of the sprue-pin. Although the actual cross-section of the channel may increase slightly, however, only metal reaching the base of the cone opposite to a runner channel can flow on without impediment. From all other parts of the sprue, metal must move circumferentially around a progressively decreasing section.

As a result, there is, in fact, little movement except in the vicinity of the runner, and the major part of the hollow cone of metal forming the sprue does not contribute to the feeding of the cavity. To improve flow, designers sometimes provide two runners, extending from the sprue at widely separated points, and connecting with a single feeding runner, if, for any reason, multiple gating is undesirable. It is also possible, of course, to provide a large capacity annular trough around the base of the sprue, although it is doubtful whether the advantages of such a channel justify the extra shot weight involved.

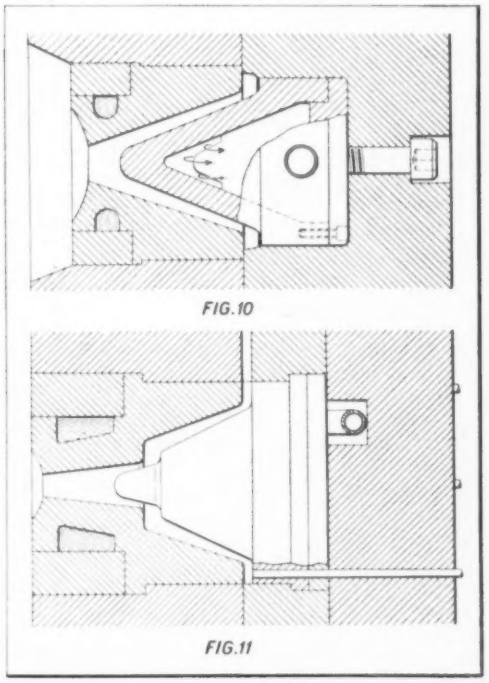


Fig. 10. The Larger the Sprue-pin, the More Effectively can Heat be Withdrawn from it
Fig. 11. Sprue of Stepped Form

REDUCING THE WEIGHT OF "DEAD METAL"

There is, indeed, every reason for reducing, to a minimum, the dead metal—sprue, runners and overflows—associated with the production of a particular die casting. The larger the component, the more important it is to ensure that every ounce of metal injected has some essential function to perform. There is no profit in melting, injecting, chilling, trimming and remelting sprue- and runner-metal, and heavy sprues of more or less

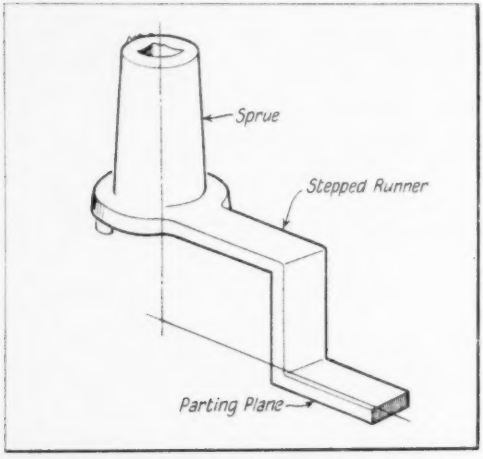


Fig. 12. By Recessing the Sprue Assembly into the Fixed Die Member, a Short Sprue with a Stepped Runner can be Provided Even in a Deep Die Block

conventional design may carry several ounces of purposeless metal, all of which costs money to melt, and even more money to chill again. When large sprue-holes are needed in thick die-blocks, it is particularly likely that much of the sprue-metal will merely provide conventional form without assisting in the filling of the cavity.

One method of achieving economy is to recess the sprue-bush into the face of the fixed die-block, the sprue-pin assembly being arranged to project correspondingly from the moving member. As a result, the length of the sprue is reduced, and it may be scaled down in proportion. From the end of the sprue proper, a runner is carried down the side of the sprue-pin base and then across the die face, as indicated in Fig. 12.

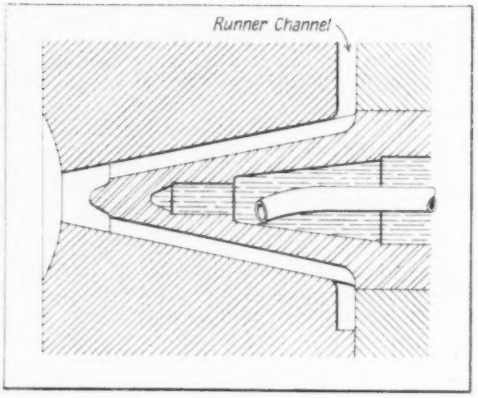


Fig. 13. The Sprue-pin Blocks the Orifice, but is Grooved on the Sides to Provide a Passage for the Metal to the Runner Channel

The volume of the stepped runner is, of course, very much less than that of a tapering annular sprue section of the same height, and the more massive sprue-pin quickly chills both the sprue and the heavier-section runner.

ADVANTAGES OF THE DIVIDED SPRUE

A variation of this design, which gives an arrangement intermediate between those of Fig. 11 and Fig. 12, can be applied effectively to sprues of almost any length. It can, in fact, be employed with advantage even in dies for producing fairly small castings in the 1 lb. to 2 lb. weight range. The sprue-pin is enlarged, as indicated in Fig. 13, until it fills the tapered bore of the bushing, so that the orifice would be completely blocked if the pin were of full form. On two sides, however, it is grooved longitudinally to form runner

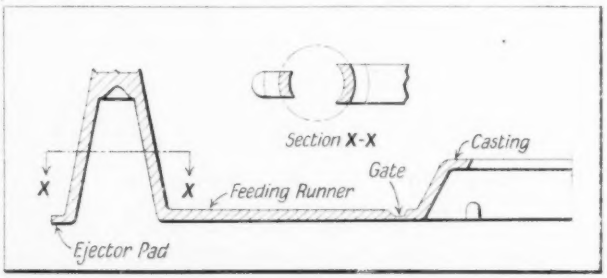


Fig. 14. Sections of the Divided Sprue from the Tool Shown in Fig. 13

channels, one of which connects with the runner cut in the face of the die.

The extreme tip of the sprue-pin is reduced somewhat, so that a small stubby sprue is formed thereon, and the appearance of the resulting spray is shown in Fig. 14. Here it will be seen that only one leg of the sprue connects with a feeding runner, the other being brought to the base mainly to form an ejector bearing, so that a balanced thrust is obtained. The figure shows the essential features of this type of feed, and many dies have been successfully operated with the legs left entirely separate, as here illustrated. There is, however, always a possibility that metal debris may accidentally remain in the tapered bore of the bushing, and it is, therefore, advisable to allow a clearance of 0·012-in. or 0·015-in. all round the sprue-pin. A thin conical shell is then formed, so that from the outside the sprue appears to be of conventional form. The actual cross-section is seen in Fig. 15, and only in the longitudinal grooves is there any appreciable flow of metal during injection.

At the right of the figure is shown a normal annular cross-section of equal area, and it will be noted how constricted is the passage for the molten metal thus provided. For high-speed operation, the divided sprue has the advantages that it permits an unchoked flow, and—because the sprue-pin is unusually large—solidifies very rapidly. As the sprue-pin can project nearly all the way through the bush, there is virtually no solid section to impose a limit on speed of operation, which can be determined solely by the chilling of the casting to a suitable temperature for ejection.

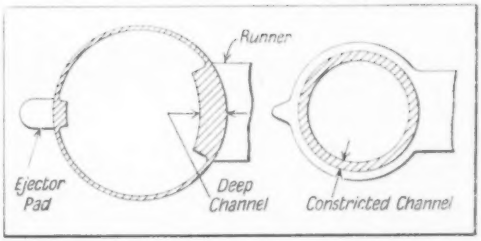


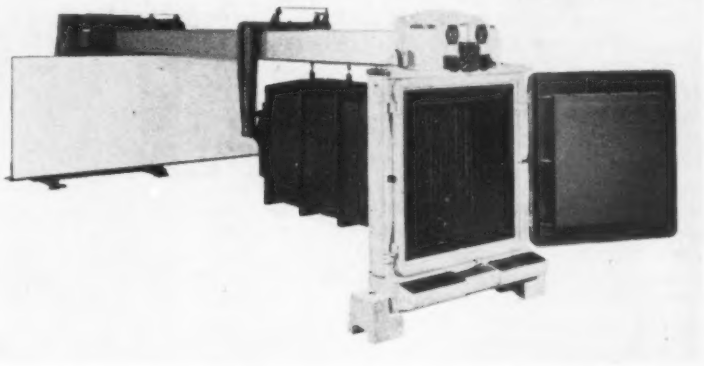
Fig. 15. A Divided Sprue with a Thin Exterior Shell (Left) Permits Much Freer Flow than the Conventional Annular Sprue of the Same Cross-sectional Area (Right)

Large Template Camera

A template camera of exceptional size has been supplied by Robertson Photo-Mechanix, Inc., U.S.A., to Canadair, Ltd., Montreal, to facilitate the preparation of templates required in connection with aircraft construction. A general view of the camera is shown in the figure. Lenses with local lengths up to 42 in. can be employed, and templates with maximum dimensions of 16 ft. by 6 ft. can be produced.

A metal master, made by the lofting process, is held in position on the copy board by vacuum and is photographed one-quarter full size. The negative is then projected on to an emulsion-coated plate of aluminium, steel, or wood, which is subsequently developed and machined to the required outline to form a working template. In addition, the camera can be used with advantage for reducing full-scale forms for the production of the models that are required for testing in wind-tunnels and for other purposes.

The vacuum pump for the copy board is driven by a 5-h.p. motor, and steel or aluminium plates weighing up to 250 lb. can be held in position.



A General View of the Large Template Camera and Copy Board

Fordath Shell Moulding Developments

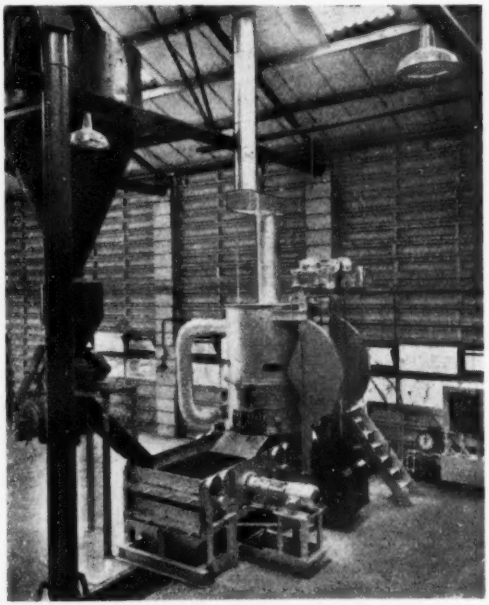
The Fordath Engineering Co., Ltd., Albion Road, West Bromwich, have recently introduced a range of liquid phenolic resins for the pre-coating of sand to be used for the production of shell moulds and cores. These resins are manufactured by Fordath, in West Bromwich, under licence from the Acme Resin Corporation, U.S.A., and a special plant, here illustrated, has been built and installed at the company's works for the purpose of pre-coating a number of different types and grades of sand, for sale under the trade-name Plastsand. The plant includes a modified No. 2 Fordath mixing machine with a batch capacity of 560 lb., which is driven by a 30-h.p. motor. A gas-fired air-heating unit, capable of delivering 1,000 cu. ft. per min. at 3-in. water gauge, supplies air heated to about 350 deg. F. to the interior of the mixer. The coated sand emerges from the mixer on to a vibrating screen for removal of lumps, and is then fed into a hopper whence it can be thrown down chutes for packing into sacks. With such a plant installed in a foundry, the sand would be delivered directly to the mould or core making machine. The plant in the company's works has too great a capacity for all but the largest users of shell moulding sand, and is at present employed solely to produce Plastsand pre-coated sand for sale.

For a smaller plant, more suitable for the needs of the average foundry in this country, a No. 4 Fordath mixing machine is provided, with a batch capacity up to 250 lb. This machine, which is driven by a 10-h.p. motor, is operated in conjunction with a gas-fired air heater of suitable size. The company also supply resin to founders who wish to coat their own sand.

Although Plastsand resins are available for application to sands in the cold condition, heating of the mixture during the mixing process, even when using the resins formulated for cold coating, has certain advantages. Mixing time is reduced, so that larger quantities of sand can be treated, and the required tensile strength of the mould can be obtained with smaller resin percentages. The hot-coating process, carried out in the plant illustrated, with resins formulated for the purpose, offers similar advantages, and since the process may be more accurately controlled, it enables sand to be prepared with very low resin content, from which moulds with tensile strengths up to 500 lb. per sq. in. can be made. The process is carried out by blowing air, at a temperature of about 350 deg. F., into the mixer and through the sand. Liquid resins and catalysts are then introduced, and mixing is continued until the reaction reaches a stage at which the temperature subsequently required to cause the resin to melt and flow in contact with the pattern can be predicted.

For patterns involving deep draws, flow temperatures of about 250 deg. F. may be required. For normal patterns, a resin melting at about 200 deg. F. may be needed, and for blowing cores a resin which melts at 185 to 195 deg. F. may be more suitable. As soon as the resin has reached the correct reaction point, previously established by experiment, the mixture is cooled by the addition of controlled amounts of water. Mixing is then continued until the charge is dry, and ready to be delivered on to the screen.

Plastsand pre-coated sand, in grades corresponding to a range of A.F.S. numbers, is now available in 112-lb. sacks, ready for immediate use.



This Special Plant has Been Installed at the Fordath Works for the Production of Plastsand Pre-coated Sand for the Shell Moulding Process

Seventh Electrical Engineers' Exhibition

Some of the products which are being displayed at the Seventh Electrical Engineers' Exhibition were discussed in MACHINERY, 92/682—21/3/58, and other exhibits are here considered.

On the stand occupied by Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, 17, may be noted the company's latest infra-red projector heater, illustrated in Fig. 1. Incorporating tubular metal-sheathed elements, this heater is intended for such applications as paint stoving, moisture extraction, and pre-heating.

Also of interest is the Magistor photo-transistor relay, details of which were published in MACHINERY, 90/1219—31/5/57. With this relay, the need for thermionic valves, large photo-electric cells, and a high tension supply is avoided, and the use of a simple circuit and printed wiring ensures reliability. The dimensions of the lamp box unit and receiver head are small, and interconnections are confined to two wires. Typical applications include counting, level control, material handling, frequency testing, and sorting.

The display also includes a selection of instruments for mounting on switchboards and control panels, the company's latest Polyphase watt-hour meters, and electric motors of various types. In addition, there is a 3-panel, type CMC, switchboard, and a 330-kV., single-phase assembly and control unit for a large air-break circuit breaker which has been built for the Snowy Mountains Hydro-electric Authority of Australia.

G.W.B. Furnaces, Ltd., Dibdale Works, Dudley, Worcs., are exhibiting some examples of the special-purpose control panels which they make for

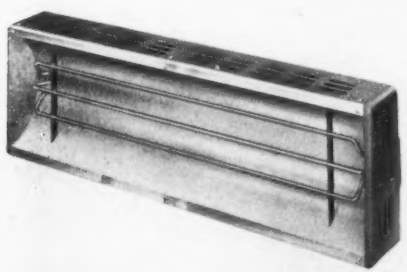


Fig. 1. Metrovick Infra-red Projector Heater

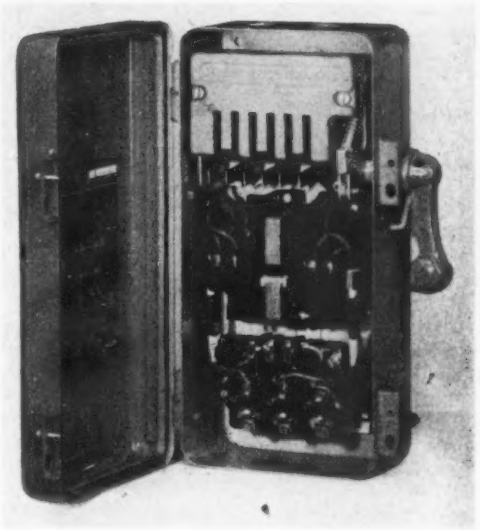


Fig. 2. Donovan Direct-on-line Starter for Motors up to 3 h.p.

both A.C. and D.C. supplies. A representative selection from the firm's range of contactors with tungsten-silver contact surfaces, which are available for A.C. and D.C. supplies from 10 to 1,400 amp., is also being shown, together with isolators as representative of a range with ratings up to 1,400 amp.

The exhibits of Aero Research, Ltd., Duxford, Cambridge, have been selected to show some of the numerous applications of Araldite epoxy resins in the electrical industry. Resins for gravity casting, which are extensively employed for transformers and insulators, and have good electrical, mechanical and chemical properties, are being displayed, and there is a selection of potted components, including small transformers, condensers, and electronic units. Hot- and cold-curing resins for glass-cloth laminate are also being exhibited.

Contactor starters and controllers, push-button and limit switches, relays, and contactors are being displayed by Donovan Electrical Co., Ltd., 70-82 Granville Street, Birmingham, 1, together with their Runtact busbar ducting with travelling con-

tact trolleys, for supplying power to hoists, cranes, and portable tools. Donlok, Safuse and Scrutact heavy-duty, iron-clad, switch- and fuse-gear, changeover switches, industrial switch sockets and plugs, and trolley wire safety switches for cranes are also on view. Another exhibit is the direct-on-line starter, with a built-in isolating switch, illustrated in Fig. 2, which is intended for use on A.C. supplies of 415 volts for the control of motors up to 3 h.p.

Examples from their range of distribution transformers, electricity meters, and industrial instruments are being shown by Ferranti, Ltd., Hollinwood, Lancs. The instruments on view include a phase-earth loop impedance tester and a disturbance recorder of the oscillograph chart type for checking faults in electricity transmission systems, also clip-on ammeters and a unit for checking high-voltage indicators.

The computer department of the company is showing a new high-speed photo-electric tape reader, which is fully transistorized and is capable of operating at speeds up to 300 characters per sec. By simple adjustment of a guidepiece, the unit can be set for handling 5-, 7-, or 8- row punched paper tape. Built-in transistor staticizers, in the form of plug-in printed circuits, will store up to eight channels of information as each character passes through the reading position, and "memorize" them until they are read by the associated computer.

The products of the electronics department are represented by semi-conductor devices, and ceramic-to-metal seals which have been developed to overcome the limits imposed on valve performance by the use of conventional glass-to-metal seals. Several forms are available for a variety of applications, and new developments include compression-type seals with diameters exceeding 3 in., for use between alumina ceramic and nickel-iron alloy, and butt seals for metal and ceramic with matched coefficients of expansion. The display also includes a selection of castings made in sand and shell moulds, as representative of the range produced by the company for the electrical, agricultural, refrigerator and small tool industries. Castings in grey iron, Nomag and Nodumag austenitic irons, spheroidal graphite iron, and Ni-Resist iron, which has a high nickel content, are on view.

Fig. 3. Rodene Type 7000 Process Timer

The British Thomson-Houston Co., Ltd., Rugby, are showing examples of their type KNC ventilated motors with class E insulation, a Stayrite single-phase motor drive unit with a push-button contactor-type starter, and a selection of new fractional horse-power machines. Industrial control equipment includes the type DOC71 push-button starter for electric motors, and a control panel for the drive of a machine tool. Also of interest is a new capacitor/D.C. braking system. The company's Emotrol electronic motor control system is being demonstrated, and among other exhibits may be mentioned an infra-red pyrometer for the remote indication of black-heat temperatures, electronic timers, and examples from the company's wide range of photo-electric equipment. A rectifier cubicle, designed for a D.C. output of 250 kW., which is being shown, incorporates germanium power cells.

Examples from their range of fluorescent lighting equipment and recently-introduced 150- and 300-watt tungsten lamps are being shown by Philips Electrical, Ltd., Century House, Shaftesbury Avenue, London, W.C.2. Other products which are on view include industrial X-ray equipment, steplessly-variable transformers, industrial mercury-vapour rectifiers, ignitrons for current rectification and for use in connection with resistance welding, voltage stabilizers, power factor correction equipment, battery chargers, and a gas-refrigerating machine, which will produce up to 1 gal. of liquid air or nitrogen, for example, per hour.

Taking part in this exhibition for the first time, Rodene Electrical Co., Ltd., 579 London Road, Isleworth, Middlesex, are showing the recently-introduced type 7000 timer, illustrated in Fig. 3. Designed for flush-mounting, this timer may be operated by a switch or push buttons, and can be arranged so that it is automatically re-set at the end of the timed period, or when a re-setting contact is opened. If required, a signal can be transmitted by the timer at the end of the pre-set period for starting a second timer, and in this way, any number of units can be brought into use automatically. The first timer in the group is then automatically re-set at the end of the period pre-set on the last unit.

This timer is available in seven different types which give cycle times from 0 to 17 sec. up to 0 to 3 hours, and it is anticipated that the range will

later be extended to include units with other working ranges. Two pointers of different colours are provided, one of which is adjusted by means of a knob, to correspond with the pre-set time. While the timer is in operation, the other pointer is traversed towards the zero mark, so that the unelapsed period is continuously indicated. If required, the adjusting knob can be mounted on a detachable shaft, which can be removed from the timer to avoid any risk of accidentally disturbing the setting. The timer, which weighs 3 lb., has a diameter of 4½ in. and an overall length of 6⅝ in.

Available for flush and surface mounting, the series 25 automatic re-setting timers, which are being exhibited, are made in various types, with cycle times of ¼, 1, 5 and 10 min. A range of timers, with adjustable multiple operating cams, which enable a maximum of 36 electric circuits to be controlled, is also being shown.

The Martinet wet-dry suction cleaning unit, displayed by the Martindale Electric Co., Ltd., Westmoreland Road, London, N.W.9, is intended for removing fluids and wet or dry dust and dirt from workshop floors and other parts of factory buildings. It comprises a castor-mounted 4-gal. tank and cover, of rust-proofed metal, to which a portable electric blower, of any size from the company's range, can be fitted. A special hose, with a 12-in. wide squeegee end-piece, is provided for the cleaning of floors.

Weighing only 3½ lb., the Port-A-Vac harness, which is also on view, enables a portable electric blower, fitted with a flexible hose for suction cleaning, to be conveniently carried on the operator's back. This arrangement gives complete freedom of the hands to facilitate climbing ladders, for example.

Other exhibits include the Martindale "super" siren, a full range of the company's portable industrial blowers, and a vibratory marking tool, which is intended for marking hardened and unhardened steels, glass, plastics and non-ferrous metals. In addition, the range of wheel pullers recently introduced by the company, and described in MACHINERY, 92/442—21/2/58, is being displayed.

A selection of Fluon PTFE electrical products, cast resin insulators, glass fibre sheets, and brush gear end covers and supports in densified wood, are being shown by Permali, Ltd., Bristol Road, Gloucester. A 14-ft. high bus-bar support, made entirely from Permali, forms the centre piece of the stand. Other exhibits include Permali arc control pots for oil-immersed switchgear, lift rods and guides, stator winding bracing parts and packings,

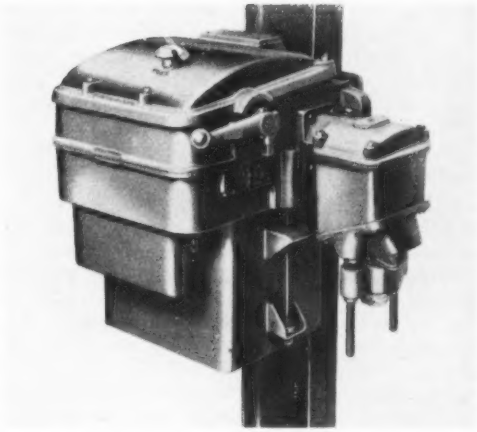


Fig. 4. Ellison GEOF Circuit Breaker

metallized surge rings and clamping rings for high tension transformers, and components for off-load and on-load tap changers. Permaglass glass fibre reinforced materials in the form of tubes, profile shapes, and large moulded parts are also on view, together with Dialam laminated paper and fabric tubes, and bushes for use in high tension switchgear and transformers.

George Ellison, Ltd., Perry Barr, Birmingham, 22b, are exhibiting a new 11-kV. oil switch, ASTA tested to B.S. 2631:1955, and a recently-introduced circuit breaker and direct-to-line starter for supplies up to 660 volts, also examples from their extensive range of distribution switchgear, motor starters, crane control equipment, tappet-operated limit switches, cable and couplings, and cable fittings.

Of the triple-pole type, the 11-kV. switch is intended for use with an oil-filled circuit breaker, and is operated manually by charging and releasing the spring with one movement of a handle, both "making" and "breaking" actions being effected independently of the operator. Blade-type contacts are fitted which give a single break per pole. A standard cable box is usually fitted on the under-side at the rear of the switch, but, if required, a bus-bar cable box may be mounted on either side. Drain cocks are provided at the bottom of the switch and the bus-bar chamber.

Illustrated in Fig. 4, the GEOF circuit breaker has a rating of 400 amp. and is ASTA tested to B.S. 936:1940. It has a breaking capacity of 25 MVA at 400 volts and 37·5 MVA at 660 volts. Suitable for mounting on a wall or

stanchion, the circuit breaker has independently reversible contacts, a trip-free handle, a cushioning arrangement for the contact mechanism, and a solenoid-operated release arrangement with oil dash-pot time lag. It is particularly suitable for sequence interlocking and can be fitted with auxiliary switches, a non-close device, and an electric interlock.

Among the exhibits of the English Electric Co., Ltd., Marconi House, Strand, London, W.C.2, may be mentioned a 3-h.p. magnetic amplifier motor control unit, a ½-h.p. Magamp motor control unit, type LY totally-enclosed fan-cooled electric motors, type C ventilated machines for foot and flange mounting, motors for the chemical industry, loom motors, flame-proof motors, and D.C. motors for cranes. Various types of fractional horse-power motors for use on business machines, coolant pumps, and humidifiers for the textile industry are also being shown, together with variable-speed geared f.h.p. motors and oil burner motors.

Reference may also be made to the type LWC200, type LWC300, and type LWC450 portable arc welding units, the type LWMC 350/6 multi-operator A.C. arc welding equipment, and the type LWR350 regulator. In addition, the products of the company's fusegear, instrument, rectifier, relay, and switchgear and transformer departments are represented.

Several recent additions to their wide range of motor control equipment are included among the exhibits of Igranic Electric Co., Ltd., Bedford. There is, for example, a new range of heavy-duty, oil-tight push-buttons, selector switches, and Prestest indicator and transformer types, the indicator lamps incorporate means whereby the bulb can be checked without the need for dismantling the unit. This equipment will be described in detail in an article that is to be published shortly in MACHINERY. The recently - introduced block-type contactors on view are of unit construction, and have snap-on covers which can readily be removed without the use of tools. They are available with ratings of 10, 20, 30 and 50 amp., and electric interlock units can quickly be fitted, if required A third new product is the Igrastat static relay.

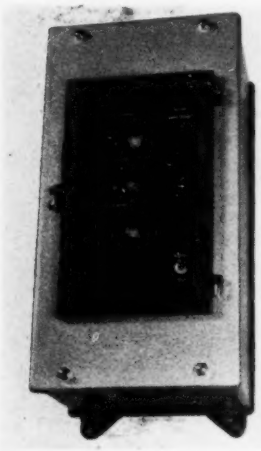


Fig. 5. Smiths Transistor Batch Counter

In addition to their standard and Newphase alternators, Arthur Lyon & Co. (Engineers), Ltd., 6 Carlos Place, Grosvenor Square, London, W.1, are exhibiting an entirely new E.S. range of self-exciting, self-regulating alternators, of the screen-protected type with drip-proof enclosures. These new alternators are available with ratings from 3 to 11·5 kVA. and an operating speed of 1,500 r.p.m. for 50-cycle supply, and from 3 to 12·5 kVA., with an operating speed of 1,800 r.p.m., for 60-cycle supply. A separate D.C. armature winding provides the no-load excitation, and an auxiliary field winding is fed from the secondary winding of a transformer, by way of a rectifier, to give the additional excitation required under load conditions. Additional windings are incorporated to give a 24-volt supply for engine starting and battery charging duties.

Of compact design, the alternators are built in accordance with the British Standard Specification 2613/57 for machines with class A insulation. They are available for foot mounting, or with flanges of different designs for direct coupling to most types of diesel engines. If required, the alternators can be supplied for direct mounting on the flywheel housings of certain types of air-cooled diesel engines. Cooling of the alternator is then effected by means of the fan on the engine.

Among the exhibits on the stand occupied by Smiths Industrial Instruments, Ltd., Chronos Works, North Circular Road, London, N.W.2, may be noted the transistor batch counter shown in Fig. 5, which can be used in conjunction with a photo-electric, electro-magnetic or electro-mechanical indicator head. It has a maximum counting speed of 1,000 per sec., and will handle up to 300 batches per min. The count is shown by Dekatron tubes, and the number of items in each batch is set by means of switches. At the end of each batching cycle, an electric signal is transmitted by a relay, which, when the counter is operated from a supply of 250 volts with a minimum power factor of 0·8, will control a current of 2·5 amp. to produce an electro-mechanical action.

Reference may also be made to the company's calibrated relay, which is intended to give close control of speed, voltage, or current.

Slough Metals, Ltd., Oxford Avenue, Slough, Bucks, are exhibiting the new Ballard Super-

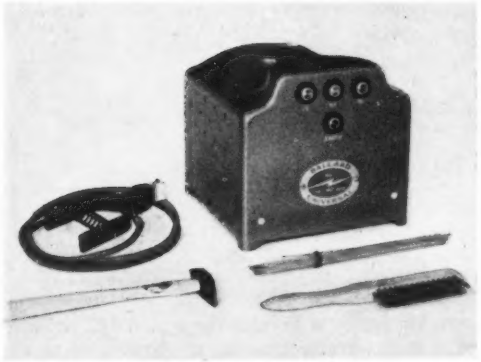


Fig. 6. Ballard Super-Dynamic Portable Arc Welder

Dynamic portable arc welder shown in Fig. 6. It has a nominal rating of 2½ kVA., and by connecting the electrode cable to different sockets in the body, outputs of 25 to 85 amp. are obtainable.

The unit may be used for brazing, soldering, cutting and pre-heating as well as for welding, and is designed for operation on A.C. supplies from 190 to 250 volts. Weighing only 30 lb., the welder measures 11 by 11 by 10½ in., and the body, which is cast in aluminium, incorporates a carrying handle.

The display on the stand occupied by Brook Motors, Ltd., Empress Works, Huddersfield, has been designed to draw attention to the extensive facilities which the company provides in most parts of the world for service and the supply of spare parts for the wide range of electric motors.

Shown at the Electrical Engineers' Exhibition for the first time is the company's type C ventilated motor, which is available in sizes from ½ to 50 h.p. Fan-cooled motors representative of a range from ¾ to 50 h.p. are also on view, together with Gryphon f.h.p. machines for grinding, buffing, and polishing duties. The Merlin range of f.h.p. motors are available with sleeve or ball bearings, and with flange or resilient mounting arrangements. In addition, a totally-enclosed machine, with a flange of special design, can be supplied for oil burner applications. These motors may be fitted with thermal cut-outs, if required, and the range includes a machine of reduced length for use on domestic washing machines. The latest light-duty industrial motor, illustrated in Fig. 7, is made in accordance with B.S. 66 for sizes from ¼ to 2 h.p., and can be supplied for operation on single- or three-phase supplies, and arranged for foot or flange mounting. A selection of light-duty control gear, including a small contactor for f.h.p. motors, is also being displayed.

On the stand occupied by Southern Areas Electric Corporation, Ltd., 28 Queen Anne's Gate, Westminster, London, S.W.1, there is a battery-operated portable transistor counter, which has been introduced by an associate company, P.A.M., Ltd. Of the 4-digit non-resetting type, this unit measures only 4¾ by 3¾ by 1⅞ in., and will count small batches at a maximum rate of 4 per sec. It is available with a built-in photo-electric cell. Alternatively, the cell may be incorporated in a separate detector head connected to the counter by a flexible cable. Of the type employed in deaf-aid units, the battery has a capacity for making 250,000 continuous counts.

Another transistor counter on view is of the 6-digit mechanical re-setting type, and may be operated from a mains supply or a 12-volt battery. Measuring 9 by 10 by 5 in., it has a maximum counting speed of 2,000 per sec., and the photo-cell and lamp units are carried in dust-proof lens-focused housings, and may be mounted at distances up to 8 ft. apart.

The Chester Junior switchboards, which are being exhibited by Brookhirst Switchgear, Ltd., Chester, have channel-section frames with pressed steel front, back, and side covers, and incorporate A.C. straight-on starters for motors up to 25 h.p., and distribution equipment with ratings up to 400 amp. Starters, switches, and switch fuses are housed in individual units, fabricated from heavy-gauge sheet steel and provided with hinged or bolted-on covers. The starters and distribution gear can readily be withdrawn as complete assemblies from the front of the switchboard, to

Fig. 7. Brook Light-duty Industrial Motor

facilitate maintenance. Starters for motors up to 7½ h.p. have plug-in connections so that they can be removed easily, without the use of tools. Of unit construction, the switchboards can be supplied with different numbers of starter and distribution units, and they can readily be extended if required. These switchboards, it may be noted, can be employed in conjunction with Chester Major switchboards, if desired.

Attention may also be drawn to the company's new Arcmaster contactor, illustrated in Fig. 8, which is available with ratings of 25 and 50 amp. It is stated to have a mechanical life exceeding 5,000,000 operations, and is capable of making and breaking loads up to eight times its nominal rating.

The new type V3 miniature switch shown by Burgess Products, Ltd., Micro-switch Division, Dukes Way, Team Valley, Gateshead, 11, incorporates an operating mechanism of entirely new design, for which improved consistency on repeat operations, high resistance to shock, and a working life exceeding 10,000,000 operations are claimed. The switch is also available as a type V3/2, for which a reduced operating force suffices, and as a type V3/4, with a reduced movement differential. Two type V3 switches can be supplied as a single unit for double-pole operation. Low-force actuators, in the form of short and long levers, are available with and without follower rollers, and incorporate a patent friction-free pivot which has a very long working life. When the long-lever actuator is fitted, the forces required for operating the type V3 and the type V3/2 switches are 1 and ¼ oz. respectively. Examples of the new switches are being demonstrated, at high operating speeds, in conjunction with a stroboscope which enables the switching action to be observed in slow motion.

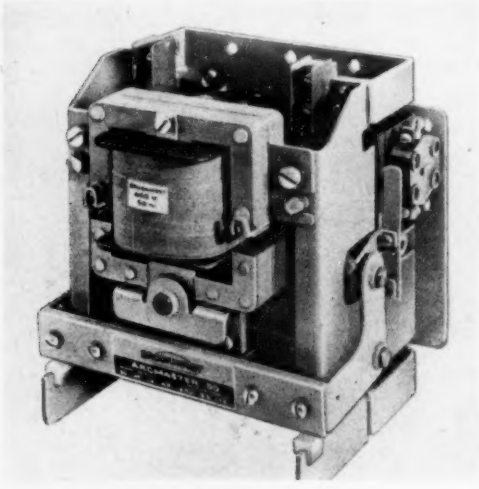


Fig. 8. Brookhirst Arcmaster Contactor

Fig. 9. Rawlplug Vibroto Portable Electric Drill

The exhibits of Hedin, Ltd., Commerce Estate, London, E.18, include examples of their latest furnaces, one of which has an Inconel muffle for heat treatments at temperatures up to 1,000 deg. C., and another is intended for operation at temperatures from 0 to 1,400 deg. C. An aluminium bale-out furnace and a prototype forging furnace are also on view, together with forced air recirculating ovens and a humidity cabinet. In addition, there is a panel-type space heating unit, and heating elements of the band, strip, and cartridge types, also elements in the form of asbestos woven nets.

In Fig. 9 is shown the new Vibroto portable electric drill which is being demonstrated on the stand occupied by Rawlplug, Ltd., Rawlplug House, Cromwell Road, London, S.W.7. Intended for drilling holes in concrete, granite, stone, brick and quarry tiles, for instance, this drill imparts combined percussion and rotary motions to the bit, so that a high rate of penetration can be obtained in pebble aggregate.

Weighing 9¾ lb., the drill has an overall length of 18½ in., and will take Rawlplug drills in sizes from No. 6 to No. 20. Drive from the motor is transmitted by gears, and the spindle speed is 940 r.p.m. The motor, which has a power consumption of 310 watts, is intended for operation on a supply of 230/250 volts, and the trigger-type switch incorporated in the pistol grip handle can be locked in the "on" position, if required, for continuous running. Mounted at the end of the gearbox, the percussion head is fitted with a knurled ring which can be turned to different positions, and located by a leaf spring, for applying

light blows in rapid succession, or heavier blows at longer intervals, to the drill bit. When the ring is set in a third position, rotary motion only is applied to the bit.

A range of special tipped twist drills, which have negative rake cutting edges, and hardened steel shanks, has been introduced for use only with the Vibroto portable electric drill.

Among the exhibits of Newman Industries, Ltd., Yate, Bristol, may be mentioned the new Thoroughbred capacitor-start, induction run, electric motor, described in MACHINERY, 92/575—7/3/58, which has been specially designed for operation on single-phase supplies. A feature of this motor is that two fairly small condensers are employed, which are housed in cored openings in the frame.

Other motors in the company's range which are represented include vertical machines with solid and hollow shafts for deep-well pumping duties, explosion-proof motors, special motors for use in ordnance factories and gas works, drip-proof machines built in accordance with the new draft British Standard Specification, and totally-enclosed machines with double-circuit cooling system.

Pratt & Whitney Jig Borer with Built-in Gauging Equipment

A modified No. 4E Electrolimit jig borer, as shown in the figure, has been developed by the Pratt & Whitney Co., Inc., West Hartford, 1, Conn., U.S.A., to overcome certain problems associated with the machining and checking of a component for nuclear reactors. Details of the form and function of this component have not been divulged, but it is said to be a massive piece in which slots more than 5 ft. deep have previously been machined. The machine has a built-in precision rotary table arranged for milling feeds, and the length of the column has been extended by 15 in. beyond the normal maximum height for this member.

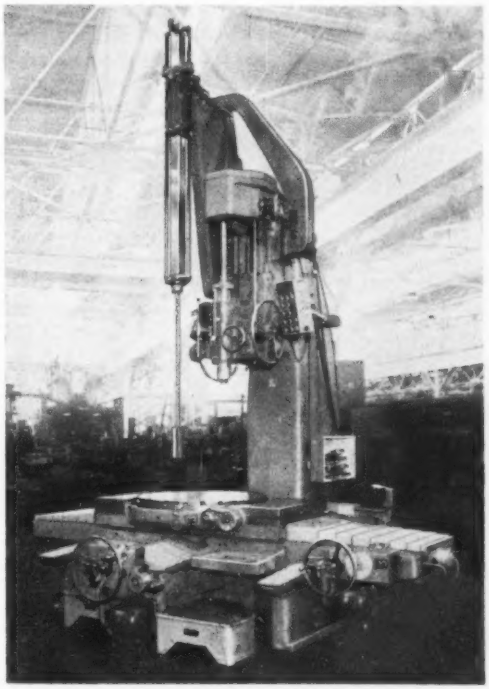
Of particular interest is the built-in gauging equipment whereby the locations of the full length "free-paths" within the work slots are determined in relation to a fixed reference point on the surface. Certain milling and boring operations are there performed in specified relationship to the free paths. It is stated that the free paths must be located in relation to two axes to an accuracy of 0·00025 in., and the work is located for the subsequent operations to ±0·0001 in.

A special probe bar, comprising a square section guiding portion and a probe extension, is mounted on the side of the column and arranged for vertical power movement. The square bar is guided by three fixed and six adjustable bearing rolls which are ground to an accuracy of 0·00002 in. In the fully-raised position, the end of the bar is nearly 23 ft. above floor level.

The grinding of the bar, which is 4 in. square by 96 in. long, is said to have been one of the most exacting tasks ever undertaken by the company. A straightness of 0·0001-in. per foot over the full length was required, and it was necessary to develop special grinding and inspection procedures. For checking the finished bar with an autocollimator, it was floated in oil on a master plate.

The lower end of the probe extension can be equipped with 12 P. & W. Air-O-Limit pneumatic gauging nozzles, six being mounted on each side. These nozzles are connected to a battery of 12 liquid column indicators.

The Pratt & Whitney Co., Inc., are represented in this country by Buck & Hickman, Ltd., Otterspool Way, By-Pass, Watford, Herts.



Pratt & Whitney No. 4E Electrolimit Jig Borer Equipped with a Special 96-in. Long Square-section Probe Bar and Gauging Extension

Superloop Splice for Steel Ropes

Visitors to the works of British Ropes, Ltd., at Anchor and Hope Lane, Charlton, London, S.E.7, were afforded an opportunity of observing the methods used in the manufacture of the recently-introduced Superloop mechanical splice, which is claimed to provide a joint with a strength equal to that of a well-made hand splice. A metal sleeve which encloses the tails of the Flemish eye splice is made from a ferrous alloy specially developed for this application. The shape of the sleeve is such that it will not force the tails of the splice into the main length of rope in a manner likely to damage the wire strands.

After it has been fitted over the tails of the splice, the sleeve is compressed radially, at a comparatively low pressure, until the enclosed wire rope strands are firmly gripped. At the completion of the pressing operation, the sleeve is filed, or ground, in order to remove the small longitudinal flashes produced on its surface by the 4-part segmental die, which can be seen mounted in a hydraulic press in Fig. 1. The spliced rope is then proof loaded, and the sleeve is stamped with the safe working load and the test certificate number. In Fig. 2 is shown a Superloop eye and stirrup which is stated to offer the advantages of a thimble while retaining the flexibility of a soft eye. The curved fitting is made in white heart malleable iron in several sizes, for ropes up to 4 in. circumference. Replacement of damaged stirrups can be carried out easily on the site.

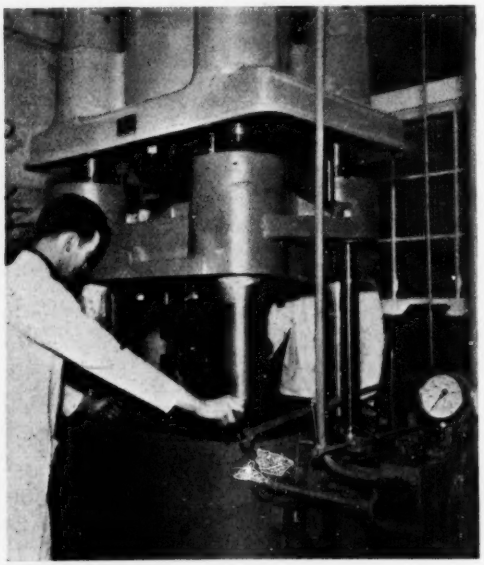


Fig. 1. Hydraulic Press Used for Reducing the Diameter of the Superloop Sleeve

Fig. 2. Wire Rope Eye with a Superloop Mechanical Splice and a Stirrup which Provides Protection from Wear

The range of Superloop slings now in production cover ropes up to 1½ in. diameter, but this upper size limit is to be extended to 2½ in. diameter. Superloop splices are made in preformed steel wire rope, in which the separate wire strands are preformed into a twisted shape corresponding to the lay of the rope. Internal stresses induced in the laying-up operation are thus avoided and when the strands of the rope are cut, they do not become unravelled.

The Denison testing machine installed in the wire rope test house is used for applying loads up to 110 tons to slings up to 50 ft. long. It is usual in these works to proof load a sling to twice its safe working load. Some 2,000 tests were performed during the development of the Superloop splicing process.

STEEL PRODUCTION IN THE U.S.A. averaged 8,387,000 tons per month in 1957, as compared with 8,573,000 tons in 1956, and 8,708,000 tons in 1955.

News of the Industry

Glasgow and District

HUGH SMITH & Co. (POSSIL), LTD., Glasgow, have now occupied the new erection shop which forms the second stage of their 3-stage building extension programme, the whole of which is expected to be completed in about 15 months' time. A brisk demand is being experienced, from both home and Continental users, for a variety of shipyard and boiler-shop machine tools. Orders in hand cover plate edge planing machines, ranging from 25 to 45 ft. stroke, combined shipyard bending rolls and flanging machines, for plate widths up to 45 ft., bulkhead flanging presses up to 1,500 tons capacity, cold ship's frame bending machines, and vertical shell bending rolls, up to 3,000 tons capacity, for plates up to 10 ft. wide by 4 in. thick. We hope shortly to make further reference to a recently-completed, 250-ton, 18-in. stroke, gap-type hydraulic press, which has a fully-guided ram and is equipped for continuous operation, and to a new type of horizontal electro-hydraulic press for general fabrication work. Export orders are in hand for Denmark, Holland, Norway and Sweden. The latest addition to the plant is a Richards No. 6 horizontal boring machine with extended table and widened bed.

A. P. NEWALL & Co., LTD., Glasgow, are busy with the production of their various types of high-stress- and high-temperature resisting steel bolts, studs, screws and nuts, also high-tensile steel structural bolts, and further works extensions are planned.

JOHN S. YOUNG & Co., LTD., Giffnock, Glasgow, report that demand for a variety of machine tools and cutting tools is steadily maintained. A working demonstration of the range of Colchester lathes was recently given at these works. We may note in course of development high-speed plate bending rolls with steplessly-variable speeds, to which we hope to refer again in due course. This firm has recently been appointed Scottish agent for the Industrial Ceramics Division of the Worcester Royal Porcelain Co., Ltd., Tonyrefail, Glam. In the fabrication department, orders are in hand for work stillages and industrial trucks, and recent plant additions include a Coborn press brake, a 6-ft. by ⅜-in. folding machine, and a 6-ft. by ¼-in. guillotine shears.

W. CROCKATT & SONS, LTD., Glasgow, are well employed in all departments. Gear-cutting of all description is in progress, and orders for electric salinometers, for both home and overseas customers, are maintained at a high level. Other active lines are valve reseaters, feed water filters and floor polishing equipment. The latest addition to plant is a Maxicut No. 3A gear shaping machine.

CROW, HAMILTON & Co., LTD., Glasgow, are occupied on bar and tube reeling and straightening machines of various sizes, and a number of special-purpose machine tools for facing and boring, swaging, and other operations. The locomotive boiler-tube de-scaling machine section despatched three of these machines to India last year.

DEMPSTER, MOORE & Co., LTD., Bonnybridge,

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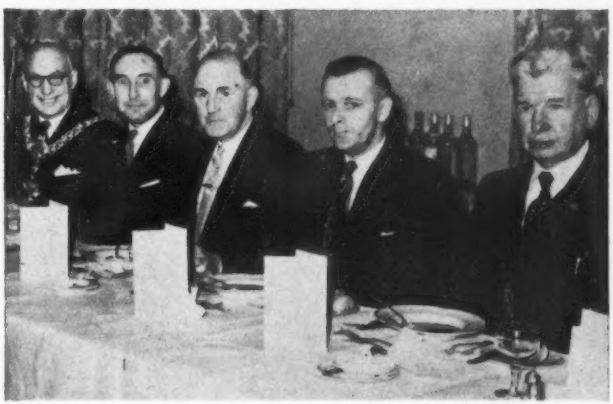
In this photograph, taken on the occasion of the recent annual dinner of the Keighley Association of Engineers, are seen (left to right) Councillor W. E. Walton, Mayor of Keighley; Mr. V. J. Wood, A.M.I.Mech.E., A.M.I.Prod.E., President of the Association; the Principal Guest, Mr. W. A. Hannaby, M.I.Prod.E., President of the Halifax and Huddersfield Section of the Institution of Production Engineers and area manager for Drummond-Asquith (Sales), Ltd.; Mr. J. Rushton, immediate Past President of the Association; and Mr. J. Riley, West Riding Federation of Engineering Societies



have a good order book for standard machine tools for use on board ship. These machines comprise lathes ranging from 6½- to 9½-in. centres, vertical drilling machines of 1½-in. diameter capacity, and 12- and 14-in. double-wheel tool grinding machines.

THE REID GEAR CO., LTD., Linwood, Paisley, have a considerable variety of gear-cutting work in hand. We may note that spur and bevel gears are on order for colliery winding and underground haulage equipment, also phosphor-bronze worm wheels and multi-start worms for rolling mill screw-down mechanism. Heavy gears and triple reduction gearboxes are on order for sugar machinery makers, and we also noted a number of lift gearboxes. In the ground gear section, work is in progress for the machine tool trade, including lathe headstock and planing machine gears.

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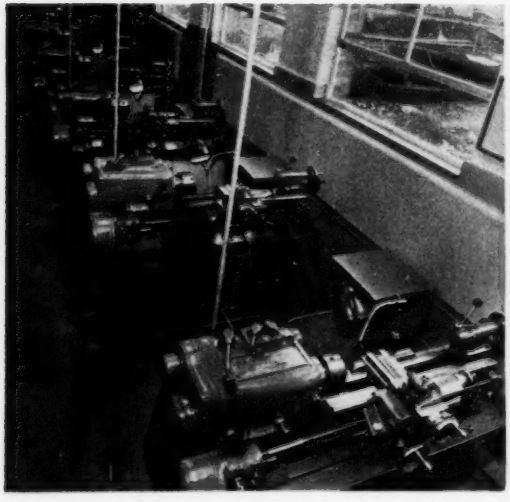
Large numbers of centre lathes have been supplied by T. S. Harrison & Sons, Ltd., Union Street, Heckmondwike, Yorks, to technical schools and training establishments throughout the country. At the left, in the accompanying illustration, is shown a battery of Harrison type L.5 lathes of 4½ in. centre height and admitting 24 in. between centres, which is installed in the Senior Machine Shop of Croydon Technical College, Croydon, Surrey. These lathes are used for instruction in connection with the City and Guilds of London Course in Machine Shop Engineering. In all, 17 Harrison L.5 lathes are installed in the College, some with 3-speed gearboxes, as shown, and others with full-range Norton gearboxes. The view at the right shows the well-arranged racks which have been provided at the College for storing the chucks, face-plates, change gears, tools and other equipment associated with the Harrison lathes. (The illustrations are reproduced by courtesy of the Chief Education Officer, Croydon Education Committee.)

THOMAS WHITE & SONS, LTD., Paisley, are steadily employed on the production of both standard and special types of woodworking machinery. Increasing demands are being made on the new department, recently brought into operation, for the design and production of jigs, fixtures, press tools and gauges. This firm is now producing the range of shear blade surface grinding machines formerly made by Luke & Spencer, Ltd., Broadheath, Manchester, and we hope to describe one of these machines at a later date.

ABBOT ENGINEERING CO., LTD., Paisley, report that the call for gear-cutting work is well maintained, and orders in hand cover spur, bevel, worm and double-helical gears, in a wide range of sizes, which are mainly destined for crane builders and other industrial users.

C. & G. OLDFIELD, LTD., whose showroom was formerly situated at 52 Carrick Street, Glasgow, have now transferred the business to 15 Abercorn Street, Paisley (telephone number, Paisley 4285 [3 lines]). A floor area of 8,000 to 9,000 sq. ft. is available, and the space devoted to the display of new and second-hand machine tools has been greatly increased. Lifting facilities are provided by a 15-ton Morris electric overhead travelling crane. This firm acts as sole agent in Scotland for several well-known machine tool makers, and the latest additions to the list of products handled are the



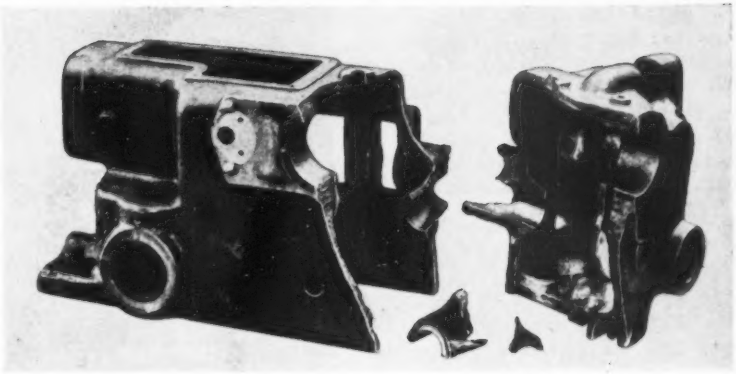
screwing machines made by Joshua Heap & Co., Ltd., Ashton-under-Lyne. Mr. A. Aikman, formerly with Rolls-Royce, Ltd., has recently joined the company's sales staff.

R. & J. Dick, Ltd., Glasgow, are experiencing a good home and export demand for their extensive ranges of flat and V-type belts. Recent developments include a Balata belt with anti-static qualities, and the oil-resisting Dixylon Suplex plastics transmission belt, which can be run at speeds up to 10,000 ft. per min. The latter is particularly intended for driving high-speed drills and grinders, and is claimed to possess good abrasion resisting and anti-static properties. Among other active lines may be mentioned Dickrope Plus V-belts and link V-belting.

Durable Tools, Ltd., Glasgow, report a steadily maintained demand for their various products, which include collapsible taps, adjustable taper threading taps, adjustable reamers, and cutter heads of various sizes. For jigs, fixtures, gauges, and moulds there is a good request from some of the newer industries which have been established in Scotland, also for precision boring work which is undertaken on the firm's Société Genevoise jig boring machine. H. B.

London and the South

Barimar, Ltd., 22-24 Peterborough Road, London, S.W.6, report that the demand for their services is well maintained. This company, which has branch service depots in Birmingham, Manchester, Newcastle, and Glasgow, has specialized for fifty years in the repair, by welding, of damaged machine tools and other plant. Frequent requests are received for the repair of machines installed in production lines, where breakdowns may have serious consequences. Replacement parts may be difficult to obtain, or, if available, may be costly, and repair by welding offers an effective and economical alternative. On many occasions the company has found it possible to restore valuable machine tools which have been severely damaged.



This Broken Lathe Saddle was Successfully Restored by Barimar, Ltd.

Among the work recently carried out may be noted the repair of the broken lathe saddle shown in the accompanying illustration. Although damage to this part involved several bearing housings, it is stated that it was successfully restored to the equivalent of its original condition.

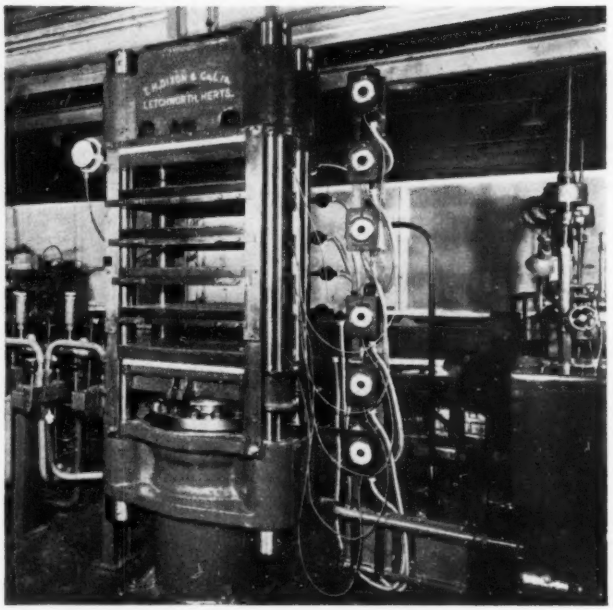
Kemworthy Jig & Press Tool Co., Ltd., 25 High Street, Colliers Wood, S.W.19, are engaged in the manufacture of specialized equipment for use in the high speed production of cans for food and various materials. Other tools in progress are destined for makers of business machinery. This firm has recently concluded an agreement to make the Harig "Grind-All" fixture for distribution in this country. Developed in the U.S.A., this fixture is designed to facilitate the grinding, to close limits, of piercing punches of all shapes. A radius dressing attachment can be supplied for use with the fixture, if required.

Habit Diamond Tooling, Ltd., 294-296 Lillie Road, S.W.6, have acquired additional premises, close to their existing works, which will eventually provide an additional 10,000 sq. ft. of working space for the production of tools, jigs, fixtures and special purpose machines, all associated with grinding processes. With the improved facilities that will be afforded, it is intended to make equipment for distribution in the highly competitive European and American markets. Among new machine tools installed in the existing works may be noted an N-2 Cincinnati tool and cutter grinder and a Jones and Shipman surface grinder.

Philip Irish & Sons, Ltd., Stone Lane, Worthing, Sussex, are engaged in the production of jigs, fixtures, and press tools. This firm has

specialized for a number of years in the construction of rubber press tools, and has also made assembly fixtures and jigs of complex shapes for the aircraft industry.

WILLIAM G. KEYTE & CO., LTD., Daux Road, Billingshurst, Sussex, who are end-bearing specialists, report an increasing demand for their "Kite" detachable swivel end bearings, which are fitted, for example, to linkages of earth moving plant, excavators, and similar equipment. These bearings are made from En.3 or En. 6 steel in a wide range of types and sizes, to suit many applications where the angular movement does not exceed 20 deg. During recent months export trade in these bearings has increased, and this development, together with the growing demands from the home market, has necessitated the provision of extra machining capacity in the works. The company also undertakes the production of machined parts on a contract basis, and is A.I.D. approved.



One of a Batch of Dixon 176-ton, Multi-daylight, Moulding Presses Recently Built for Export

THOMAS KEATING, LTD., Daux Road, Billingshurst, Sussex, who specialize in the design and production of press tools, have a number of interesting multi-stage piercing and blanking tools in progress for stator and rotor laminations for miniature electric motors. Machining facilities have been augmented by the installation of a Moore-Catmur jig-grinding machine. The apprentice training scheme instituted by this company 15 years ago provides an extended course of instruction in the craft of tool-making for selected trainees.

T. H. DIXON & CO., LTD., Works Road, Letchworth, Herts., have been engaged for many years in the design and production of special-purpose machines for many branches of industry, and particularly the photographic, rubber, plastics, and paper converting industries. Hydraulic presses with heated platens are made in a wide range of sizes for vulcanizing and moulding processes. The illustration shows one of a batch of 176-ton capacity presses recently supplied as part of a large export order. Each platen is arranged for thermostatic control so that the temperature can be held within prescribed limits. This company also produces small electrically- or steam-heated laboratory type presses.

Showrooms in which machines can be demonstrated enable potential users to assess the suitability of the equipment for specific applications.

SIGMA INSTRUMENT CO., LTD., Spring Road, Letchworth, Herts., are experiencing a good demand for their simplified air gauging units which were introduced last year, and described in MACHINERY, 91/449—23/8/57. This company is very busy at present, and has orders in hand for well-known firms in this country and on the Continent. Sigma multi-dimensional precision measuring equipment in various forms is being increasingly supplied for checking components of both simple and complicated shapes. The Sigmatic automatic transfer gauge, for example, will inspect motor-car crankshafts automatically at the rate of 70 per hour, and incorporates a punched card system which records dimensions of a component not within the specified tolerances. A gauge of this type can be installed in a transfer line.

CROYDON TOOL AND CASE HARDENING SPECIALISTS, Union Road, Croydon, Surrey, are still busy with work received from many areas. The premises have again been extended to enable additional facilities for heat treatment to be provided.

F. W. H.

The Midlands

ARTHUR SCRIVENER, LTD., Tyburn Road, Birmingham, are as busy as ever with the production of centreless grinding machines which are now used to an increasing extent for a variety of work, including precision bearing components. The outer surfaces of ball bearing races, for example, can be ground to close tolerances at high output rates. It may be recalled that this company was acquired by Wickman, Ltd., some time ago, and the administrative offices and works have since been altered to provide improved conditions for the employees and permit better utilization of floor space.

New machine tools, including a Planers planing machine and a Collet & Engelhard horizontal boring and milling machine, are enabling increased production to be obtained. Reorganization of the stores and the inspection departments has also been carried out with good results. Materials handling equipment of modern design is used throughout the works.

WESTON MACHINE TOOL CO., LTD., Bracebridge Street, Aston, Birmingham, are very busy with orders for box angle- and swivel angle-plates of various sizes, also for V-blocks ranging in length from 3 to 20 in., for which there is a sustained demand. This firm has been engaged in the production of grinding wheel dressers for many years, and a large output is maintained. During recent weeks, the Weston air/hydraulic work table, which can be attached to existing milling machines of the hand-feed type, has been demonstrated with considerable success. Production of these units is to be increased in order to meet the anticipated demand.

BENTON & STONE, LTD., Aston Brook Street, Birmingham, 6, are busy with the manufacture of a wide range of pneumatic equipment for which there is a sustained demand. Exports to the European markets are increasing, and Enots air cylinders and valves, in particular, are now widely employed. New products are continuously being added to this firm's range, and one of the most recent is an electro-pneumatic timing unit which incorporates a synchronous motor and gear train for controlling the timed operation of an air valve during a cycle which may range from 0 to 60 sec. An air-operated 3-in. vice—known as the Abwood/Enots—with a clamping force of 560 lb., has also been introduced. The vice, made by Abwood Machine Tools, Ltd., Princes Road, Dartford, Kent, is fitted with the Enots 1½-in. bore air cylinder. It is stated to be suitable for holding work for drilling and light milling operations, and is obtainable from Abwood or Benton & Stone, Ltd. The film "Air Controlled," which was introduced by Benton & Stone, Ltd., last year, is being shown to invited audiences throughout the country in order to stimulate interest in the application of pneumatic equipment. The film is also available on loan to manufacturers and other organizations, and there is a regular demand.

CLARKSON (ENGINEERS), LTD., Nuneaton, inform us that sales of their Autolock and Dedlock milling chucks and cutters are higher than for the same period last year, and production is being expanded as the recently completed factory extensions are brought into use. The demand for Clarkson spiral side and face cutters has increased rapidly since they were introduced two years ago. Export business with Continental countries, and particularly Germany, now accounts for an appreciable proportion of the company's production.

WARWICK PRODUCTION CO., LTD., Birmingham Road, Warwick, are making large quantities of pressed, drawn, and spun aluminium parts, also structures weld-fabricated from light alloy plate and sheet. In the former category may be mentioned "fish-kits," landing trunks, and transport boxes, which are used for handling fish on the dock-side and for transportation of fish from port to consumer. Other products include milking machine pails, stacking and nesting boxes, and a variety of trays, tables, racks and trolleys for hygienic handling of food.

The press shop is well equipped and contains, among other machines, a 400-ton British Clearing press and a Toledo press of similar capacity. In addition, a Lake Erie 670-ton press is installed. A specially constructed machine, incorporating Argonarc welding equipment, is used in the welding shop for joining the light alloy panels which form the main structure of tote bins now used in increasing numbers for transporting foodstuffs and other substances in granular or powdered form. The framework of the machine is of welded channel-section construction. A runway is provided for the B.O.C. Argonarc travelling welding head, and air cylinders, acting through toggle mechanisms, are employed for clamping the work.

Another part of the works is equipped for the fabrication of sheet metal structures, and for this purpose new plant has recently been provided, including a Sciaky type RAMU.50 seam welding machine, fitted with an electronic timer. A hydraulically-controlled power spinning lathe is to be installed in the near future.

F. W. H.

Books Received

FOREMAN—AN ANNUAL FOR SUPERVISORS. Industrial Welfare Society Inc., Robert Hyde House, 48 Bryanston Square, London, W.1. 64 pp. (Price 2s.)

In the sixth issue of this publication, the practical outlook of previous numbers has been retained. Articles are included under the following headings: problems of old age on the factory floor; do women prefer men supervisors? reducing disciplinary problems; developing trainee interest; getting the best man for the job; suggestion schemes; and ergonomics and the foreman.

F.B.I. FUEL ECONOMY REVIEW, 1958. Federation of British Industries, 21 Tothill Street, London, S.W.1. [Price 5s.]

The 36th edition of this publication includes articles under the following headings: the Central Electricity Authority's programme for nuclear power (by Lord Citrine); the utilization of fuels in an integrated steelworks; electric furnace economics; instrumentation and automatic control of shell boilers; the calculation and use of "degree days"; some modern developments in boiler feed water treatment; and simple smoke indicators.

TOLERANCES FOR THE MACHINING OF THERMOSETTING LAMINATED PLASTICS. The British Plastics Federation, 47 and 48 Piccadilly, London, W.1. 8 pp. [Price 2s. 6d.]

Intended to provide a code of practice for the designer and user of parts machined from laminated plastics sheet, tubing, rod and moulded sections, and in particular from laminates with a paper, woven fabric, or wood veneer filler, this booklet sets out two classes of tolerances which the fabricator members of the Federation have found to be practical and reasonable. Sections are included covering lateral dimensions; squareness of panels; thickness of sheet; diameters; holes; and slots, steps and counterbores.

INDUSTRY FIGHTS CORROSION. *Corrosion Technology*, Leonard Hill House, 9 Eden Street, London, N.W.1. 107 pp. [Price 21s., post free.]

This publication contains the proceedings of the Corrosion Convention which was organized by *Corrosion Technology*, and held in October last. In all, 13 papers were presented, and were concerned, for example, with corrosion in the shipping, petroleum, atomic energy, and chemical industries; metals; paints; plastics; packaging; cathodic protection; fuel additives; and hot galvanizing. The papers are illustrated, where appropriate, and notes on the discussions are appended.

GRADING OF METALLIC STARTING RESISTORS FOR ELECTRIC MOTORS WITH EXAMPLES. By E. W. Brass, Grad.I.E.E. The Association of Engineering and Shipbuilding Draughtsmen, Onslow Hall, Little Green, Richmond, Surrey. 67 pp. [Price 3s. or 1s. 6d. to Association members.]

Following brief introductory notes, in which it is pointed out that the subject is one which does not receive very extensive treatment in the normal text-books, sections are devoted to D.C. motors, the A.C. slipring motor, and primary resistor starters. There are numerous examples to illustrate the applications of the various formulae.

THE FUNDAMENTALS OF JIG DESIGN. By W. H. Storey. The Association of Engineering and Shipbuilding Draughtsmen, Onslow Hall, Little Green, Richmond, Surrey. 46 pp. [Price 3s. or 1s. 6d. to Association members.]

This pamphlet, which was first published during the 1921/1922 session, has been brought up to date by Mr. D. Watson, a member of the National Technical Sub-Committee. First, a method of procedure in jig design is outlined, and there follows a "danger list" of questions to be asked and answered before a design is passed. The various stages of procedure are then considered in detail and numerous drawings are included to illustrate the various points of design. Some notes are appended on pneumatic and hydraulic aids.

GRUNDZUGE DER VERZAHNUNG. By A. K. Thomas, V.D.I. Carl Hauser Verlag, Kolbergerstrasse 22, München 27. 265 pp. with 284 pp. of tables. [Price 34 D.M.]

The choice of suitable gearing, having regard to ratios, speeds, methods of production, and kinematic performance, is not always easy. In his book, Mr. A. K. Thomas treats this many-sided problem systematically. A general description of various gear forms is followed by more detailed treatments of spur and helical gears, worm and worm wheels, and bevel gears, also special types of gears. Other matters covered include the forces acting on the teeth, and bearing loads, also geometric and kinematic factors.

An unusual arrangement and binding have been adopted, so that the book opens in the middle, the text matter forming a separate section, with the spine on the left, and the tabular matter another section, with the spine on the right.

ENGINEERING FOR STEEL. Edited by Peter Nickel. Demag A.-G., Duisburg, Germany. Distributed in the United Kingdom by Intermedia, Ltd., 44 Chandos Place, London, W.C.2. 274 pp. [Price 63s.]

This strikingly presented publication which includes a large number of illustrations, many in four colours, is concerned with the history and achievements of the Demag organization since its inception in 1819. The main sections are devoted to technical problems, integrated plants, iron-ore reduction plants, steel plants, rolling mills, and cranes and handling equipment for iron and steel plants, also to landmarks in the development of the business. Treatment is mainly pictorial, but considerable information of interest is also included. In the section on steel plants, for example, it is pointed out that the annual output of open-hearth and basic Bessemer plants so far supplied by Demag is 37,000,000 tons. Under this heading there are sub-sections on open-hearth, converter, oxygen-conversion, electric furnace, and balanced steel plants, also some brief notes on the continuous casting process for steel.

As an indication of the widespread activities of the company, a list is included showing some of the large-scale projects, in various countries throughout the world, with which they have been associated since 1952.

Trade Publications

LODGE PLUGS, LTD., Rugby.—Booklet concerned with Sintox industrial ceramic. The physical properties of the material are listed, and typical applications are illustrated.

EXPANDITE, LTD., Chase Road, London, N.W.10. Leaflet concerned with Expandite guns for the application of Seelastic and Asbestumen compounds for factory maintenance purposes.

ROYLES, LTD., Irlam, Manchester.—Catalogue page covering type FC float-operated mercury switches for automatic water level control of steam boilers. This type has been introduced to supersede types DA, FB, and G.

L. & T. I. BROCK & CO., LTD., Stephen Street, Coventry. Price list of rollers and pins for roller boxes for use on various makes and types of capstan and turret lathes and automatics. Most of these items can be supplied from stock.

THE INCANDESCENT HEAT CO., LTD., Cornwall Road, Smethwick, Birmingham. Folder V53 is concerned with the construction and advantages of the Incandescent-Laclede tile suspended arch for high temperature furnaces where a considerable thickness of insulation is required.

BRITISH ENGINEERS' SMALL TOOLS & EQUIPMENT CO., LTD., Buckingham House, Buckingham Street, London, W.C.2. Brochure describing the services offered by the BESTEC Group, and giving brief particulars of the products of the various member companies which number 14. Collectively, these products cover a very wide range.

R. G. BOARDMAN (TOOLS), LTD., 44 Summer Row, Birmingham, 3.—Catalogue covering the company's ranges of drill conversion sleeves; adjustable adapters for use on multi-spindle drilling heads and transfer machines; and their radius truing dresser for convex and concave radii up to 3½ in.

LANCASHIRE DYNAMO NEVELIN, LTD. (Rectifier Division) Hurst Green, Oxted, Surrey. Leaflet concerned with direct-to-mains Varionic variable speed drives which incorporate Nevitron single anode rectifier tubes so that rectifier transformers are eliminated. These tubes are available to 50 and 100 amp. sizes.

JAMES STOTT & CO. (ENGINEERS), LTD., Vernon Works, Oldham, Lancashire. Well-produced and fully illustrated brochure of 28 pages entitled "more tea please." Sections are included on: planning the tea service; tea and tea making; water boilers; multipots; teamaking plant; cleanliness; trolleys for mobile service; special forms of service; canteen service counter; and care of equipment.

E. I. DU PONT DE NEMOURS & CO., Wilmington 98, Delaware, U.S.A. Book of 76 large pages entitled "du Pont fibres in Industry." Sections are devoted, for example, to air springs, belting, filter media, hose, industrial coated fabrics, non-woven industrial felt, packings for valves and pumps, reinforced plastics, ropes, properties of fibre, and identification of fibres. There are numerous illustrations, and a comprehensive index facilitates reference.

FLEMING SAFETY EQUIPMENT, Division of J. & R. Fleming, Ltd., 146 Clerkenwell Road, London, E.C.1. Leaflet showing examples of the company's industrial optical equipment which includes readers and magnifiers, counterpoised inspection magnifiers and lamps, and special single lenses from ½ to 3 in. diameter. Other products include diamond impregnated tools and abrasive powders.

CREED & CO., LTD., Telegraph House, Croydon, Surrey. Well presented and illustrated publication, of 52 large pages, devoted to teleprinters and punched tape equipment. The first part is concerned with teleprinters and includes a section on basic principles and an outline description. Part two comprises sections on punched tape technique, types of punched tape equipment, applications to digital computers, and further punched tape applications.

SENTINEL (SHREWSBURY), LTD., Shrewsbury.—Attractively presented brochure of pocket size concerned with the company's unit construction machine tools and their applications. The design of the electro-mechanical head is effectively shown by means of a cut-away illustration. These heads are made in three sizes with motors of 1½, 5, and 10 h.p., and with various stroke lengths. A section of the brochure is devoted to the various standard columns, bases, and tables which are available. Some typical machines incorporating these units are illustrated, and notes are included on technical planning and service.

BRONX ENGINEERING CO., LTD., Lye, Nr. Stourbridge, Worcs.—Catalogue, printed in two colours throughout, giving illustrations and specifications of press brakes of all-steel welded construction with capacities from 20 to 50 tons. Attention is drawn to various features of design, and typical tooling arrangements are shown. In addition, some guarding systems are illustrated and useful information is included, for example, on bending and punching pressures. Another catalogue is devoted to plate bending rolls which are made in 3-roll pyramid, and 3-roll and 4-roll initial pinch types. The former can be supplied with capacities from ¼ in. by 6 ft. to 2 in. by 20 ft., and the latter from ¼ in. by 6 ft. to 1⅛ in. by 10 ft. or ½ in. by 20 ft. There is also a light series of 3-roll initial pinch machines with capacities down to $\frac{1}{16}$ in. by 4 ft.

MACREADY'S METAL CO., LTD., Usaspead Corner, Pentonville Road, London, N.1. Booklet of convenient pocket size, with stiff cover, devoted to the company's standard stock range of quality steels and specifications. The first 63 pages are concerned with the materials and sizes available which are listed under 21 different headings. In each of these sections the necessary information is clearly set out. The remainder of the booklet, which extends to 150 pages in all, contains useful tables and data and a comprehensive index. In this data section there are tables, for example, for B.S. tolerances for bright steel bars, comparison of gauges, conversion of temperatures, comparison of hardness, and weights of steel bars and strip. A folding plate gives a summary of steels stocked, with chemical compositions and mechanical properties.

Industrial Notes

CROMPTON PARKINSON, LTD., are opening an additional stores and trade counter for batteries, cables, lamps, lighting fittings and small motors at College Gardens, Edmonton, N.18 (telephone number, Edmonton 7141).

WILLIAM STEWARD & CO., LTD., 154 Albany Street, London, N.W.1, who are electrical engineers and contractors specialising in industrial installations, recently celebrated their Silver Jubilee.

PRODUCTION OF MOTOR CARS IN FEBRUARY reached the record total, for this month, of nearly 83,500, and the number exported (42,000) was also the highest for any February.

NORTHERN ALUMINIUM CO., LTD., inform us that their Birmingham area sales office has been moved to Devonshire House, Great Charles Street, Birmingham, 3 (telephone number, Central 7393).

GENERAL MOTORS-HOLDEN, Australia, are to spend £6,993,000 for expanding the production of Australian Holden motor cars from 100,000 to 125,000 anually. This programme will bring the firm's post-war expenditure on plant and equipment to about £46,000,000.

MACHINE TOOL ORDERS during December, 1957, were valued at £6,415,000 (including £1,368,000 for export). Deliveries during the month totalled £7,323,000, of which £1,867,000 was for export. At the end of the year, the value of orders on hand was £78,697,000 (including £19,387,000 for export).

C. A. PARSONS & CO., LTD., Heaton Works, Newcastle-on-Tyne, are to receive an order, valued at £5,000,000, from the Central Electricity Generating Board, for a 550,000-kW. turbo-generator with condensing and feed water heating plant. It is believed that this generator will be the largest in the world.

A CONFERENCE ON THE PROBLEMS OF TRAINING is being arranged by the Ergonomics Research Society and will be held at Bristol University from April 13 to 16. Particulars and application forms can be obtained from Mr. S. Griew, Department of Psychology, 22 Berkeley Square, Bristol, 8.

SANDVIK SWEDISH STEELS, LTD., recently moved into their new offices, warehouse and factory at Manor Lane, Halesowen. Here a wide range of products will be handled, and the improved facilities available will enable better service to be given to users of their Swedish steels, carbide tipped tools, saws and hand-tools.

THE BRITISH STRADDLE CARRIER CO., LTD., Fison House, 95 Wigmore Street, London, W.1, inform us that their Steelmaster and Timber Wolf straddle carriers, type MKIA, are now supplied, as standard, with power-assisted steering whereby manoeuvrability is considerably improved. Conversion units are available for existing carriers, and can be fitted by users.

PEARSON PANKE, LTD., 1-3 Hale Grove Gardens, London, N.W.7, inform us that they have acquired a showcase in the main concourse of the central building at London Airport. In this case, products made by customers on Schuler machines will be displayed. Machines will also be illustrated by means of models and photographs.

TWIFLEX COUPLINGS, LTD., a subsidiary of Sheepbridge Engineering, Ltd., have introduced Twiflex disc brakes (incorporating Dunlop disc brake operating units) for their range of power transmission equipment, for all types of heavy industrial applications. Mr. W. R. Dearden, A.M.I.Mech.E., has been appointed senior engineer of the Industrial Disc Brake Department.

THE WAVERLEY GOLD MEDAL ESSAY COMPETITION will again be held this year. Prizes are awarded for essays on recent scientific research or new developments, which should be written so that they are clearly intelligible to scientists engaged in other fields or directors of industrial firms. Full particulars can be obtained from *Research*, 4 and 5 Bell Yard, London, W.C.2.

THE PURCHASING OFFICERS ASSOCIATION, Wardrobe Court, 146A Queen Victoria Street, London, E.C.4, have made arrangements for a series of meetings in important industrial centres, which will be addressed by Dr. Howard T. Lewis, A.M., Ll.D., Professor of Marketing, Emeritus, Graduate School of Business Administration, Harvard University, U.S.A. Particulars of these meetings can be obtained from the above address.

TALBOT TOOL CO., LTD., have acquired the share capital and premises of K.D.L. Precision Engineers, Ltd., Crowhurst Road, Hollingbury, Brighton, 6, Sussex. Two directors, Mr. R. W. Griffiths and Mr. G. A. Bennett, have been appointed from the parent company to the board of K.D.L. The additional space thus made available has permitted transfer of the London office to Brighton, and all matters concerned with sales should in future be addressed to the K.D.L. works. Orders and enquiries should be directed to "Grip" Works, Roedale Road, Brighton.

GUILDFORD & DISTRICT PRODUCTIVITY ASSOCIATION, 14 Vicarage Gate, Onslow Village, Guildford, have made arrangements for a residential work study course to be held at Moor Park College, Farnham, Surrey, from April 14 to 18. It is stated that this is the first residential course to be provided by a local Association of the British Productivity Council. In addition, a work study course for the printing industry is being organized in co-operation with the Printing Department of the Guildford School of Art, and will be held from May 5 to 9. Further particulars can be obtained from Mr. R. H. Sanders, Guildford Technical College.

K. S. PAUL, LTD., Great Western Trading Estate, Park Royal Road, London, N.W.10;, inform us that they are now agents in this country for the following West German companies:

Wanderer-Werke, A.-G., milling machines and thread milling machines.

Herminghausen-Werke, G.m.b.H., small diameter, precision centreless grinders with automatic operating cycles.

Otnima Maschinenfabrik, special-purpose machine tools for milling, drilling, tapping, etc.

A. Burger & Soehne O.H.G., small pneumatic presses.

Keller & Knappich, G.m.b.H., automatic transfer welding machines.

A ONE-DAY CONFERENCE ON STATISTICAL SAMPLING in industry, organized by the Birmingham Group of the Industrial Applications Section of the Royal Statistical Society, will be held at the Birmingham College of Technology on May 7. In this connection it is pointed out that collection and analysis of numerical information is a basic need of industrial management. The collection of this information can be done simply, effectively and economically by using suitable sampling methods, and the speakers at the conference will outline techniques designed for this purpose and indicate appropriate methods of analysis. Further details and application forms can be obtained from Mr. D. Goldberg, A.E.I. Lamp & Lighting Co., Ltd., Melton Road, Leicester.

CANADIAN SECTIONAL MEETING OF THE WORLD POWER CONFERENCE.—Copies of the general programme issued by the Canadian National Committee in connection with the above meeting, which is to be held in Montreal from September 7 to 11, 1958, are now available and can be obtained from the secretary, British National Committee of the World Power Conference, 201-202 Grand Buildings, Trafalgar Square, London, W.C.2. Each copy sent to an address in the United Kingdom will be accompanied by an explanatory circular letter dealing with the journey to and from Canada, the post-conference tours, currency arrangements and other matters. All applications must be submitted through the British National Committee, and the necessary forms are contained in the general programme.

AN ELECTRONIC COMPUTER EXHIBITION and business symposium will be held at Olympia, London, from November 28 to December 4. More than 40 British manufacturers of electronic computers and ancillary equipment, including all the leading companies, have taken space.

The exhibition and symposium are being organized at the instigation of the National Research Development Corporation by the Electronic Engineering Association and the Office Appliance and Business Equipment Trades Association. Immediately preceding these events an associated scientific symposium, organized by the National Physical Laboratory, will be held at Teddington, from November 24 to 27. Admission will be by invitation.

Further information concerning the exhibition and business symposium can be obtained from the Exhibition Organizer, 11-13 Dowgate Hill, London, E.C.4.

SIEMENS EDISON SWAN, LTD., 155 Charing Cross Road, London, W.C.2. A well-presented and fully-illustrated brochure has been issued, under the title "Siemens Bros. 1858-1958," to mark the centenary of the founding of the business of Siemens Brothers & Co., Ltd., which was amalgamated last year with The Edison Swan Electric Co. The history of the firm is briefly outlined, and attention is drawn to some of its outstanding accomplishments. Of particular interest is a map showing the locations of submarine telegraph cables made and laid by the company.

A centenary lecture entitled "100 years of electrical engineering" was recently delivered by Dr. J. N. Aldington, B.Sc., M.I.E.E., chairman and managing director of Siemens Bros., and managing director of Siemens Edison Swan, Ltd. In addition, a Sir William Siemens Exhibition was staged. This exhibition, it may be noted, has been transferred to the Imperial Science Museum, South Kensington, where it will be on view for at least six months.

THE NICKEL BULLETIN for February, 1958, published by The Mond Nickel Co., Ltd., Thames House, Millbank, London, S.W.1, includes abstracts relating to a wide range of literature. Of particular interest are the sections concerned with electrodeposition and heat and corrosion resistance materials. The former includes items referring to recent developments in the application of ultrasonics to electrodeposition, the influence of electrodeposited coatings on the cracking of high-strength steels, and the benefits to be derived from the use of nickel pre-flashed sheet for vitreous enamelling. Reference to a compilation covering the compositions and rupture strengths of some 225 high-temperature alloys forms an introduction to several items which reflect the importance of nickel-containing alloys and steels for service under the stress and temperature conditions involved in aircraft operating in normal and supersonic flight. In this connection, information on heat-treatments used for age-hardenable stainless steels is summarized in ready-reference form, together with the designations applied to the steels in the various conditions of treatment.

Personal

MR. E. A. CROKER has been appointed a director of Douglas Equipment, Ltd., Cheltenham.

MR. J. R. BUNCE has been appointed commercial manager at the Willesden Works of Lancashire Dynamo & Crypto, Ltd., with responsibility for the Estimating and Contracts Departments. He succeeds Mr. W. H. Cable, who is retiring after 37 years with the company.

MR. F. H. LAWDER, chief labour superintendent of The United Steel Companies, Ltd., 17 Westbourne Road, Sheffield, 10, has been elected president of the Iron and Steel Trades Employers' Association. He succeeds Mr. W. F. Gilbertson, of Richard Thomas and Baldwins, Ltd.

MR. ARTHUR BOOTH has been appointed director and general manager of Landmaster, Ltd., Hucknall, Nottingham. He spent many years with Jowett Cars, Ltd., and for the past seven years was with Cyclemaster, Ltd., where he became general manager. Landmaster, Ltd., is a member company of the Firth Cleveland Group.

MR. EDWARD E. TOON, works director of Weldall & Assembly, Ltd., Stourbridge, Worcestershire, has been appointed managing director of the company in succession to SIR GRAHAM CUNNINGHAM, who has resigned from the position but remains chairman. Sir Graham is chairman and managing director of the Triplex Group.

MR. A. SABINE of Hadley Hurst, Church Road, Polegate, Sussex (telephone number, Polegate 345), and MR. K. IDDENTEN of Kendal, 18 Wentworth Road, Barnet, Herts. (telephone number, Barnet 8326), have been appointed additional London and South of England representatives for F. M. Parkin (Sheffield), Ltd., Sheffield. They will assist Mr. W. J. Percy, and will operate from the London office and warehouse at 6-9 Red Lion Market, Finsbury, E.C.1.

MR. S. A. COMLEY has been appointed London area manager of the Tool Steel Division of Uddeholm, Ltd., and will operate from the company's offices at 6-10 Dean Farrar Street, Westminster, S.W.1 (telephone number, Whitehall 9233). This appointment has been made on account of the growth of the tool steel business in London and the Home Counties. For the past five years Mr. Comley has been tool steel representative in Birmingham for the firm, and has been succeeded in this position by Mr. A. G. Shaw.

Obituary

MR. C. K. BIRD, who, until he relinquished the position for health reasons at the end of March, 1956, was manager of turbine contracts for The British Thomson-Houston Co., Ltd., Rugby, has died at the age of 65. From the time of his retirement, he was consultant to the manager of turbine contracts.

MR. NORMAN W. TAYLOR, director of Cha.'es Taylor (Birmingham), Ltd., Bartholomew Street, Birmingham, 5, died recently at the age of 64. He had been with the firm all his working life, and for many years held the position of works manager. He was appointed a director in 1946.

Machine Tool Exports and Imports

EXPORTS OF MACHINE TOOLS

Type of Machine	Month ended January 31		
	1956	1957	1958
	Value £	Value £	Value £
New, complete—			
Boring machines:			
Vertical	18,495	31,403	36,832
Other	23,648	79,295	61,464
Drilling machines	143,221	204,640	186,423
Grinding (excluding thread grinding), lapping and honing machines	211,024	169,550	146,628
Lathes:			
Automatic	135,440	134,562	113,569
Capstan	199,023	170,754	155,815
Other	261,687	259,418	274,331
Screwing machines	8,491	24,061	21,302
Threading machines	37,741	55,000	37,914
Milling machines (excluding thread-milling) and gear cutting machines	156,484	171,450	227,939
Planing, shaping and slotting machines	60,832	46,242	116,811
Presses:			
Hydraulic	94,019	42,713	60,258
Other	80,533	65,105	217,202
Punching and shearing machines	22,252	9,402	36,335
Other plate and sheet metal-working machines including straightening rolls	15,451	20,827	11,103
All other machines	125,863	212,864	228,896
Used machines, complete	88,902	40,149	44,215
Parts	124,305	155,321	186,307
Total	1,807,411	1,892,756	2,163,344
Destination			
Union of South Africa	93,840	109,980	177,690
India	296,342*	216,717	323,593
Australia	313,434	267,028	479,263
New Zealand	39,403	31,036	40,634
Canada	102,555	123,189	122,004
Other Commonwealth countries	165,013	147,460	157,416
Soviet Union	98,879	57,755	5,682
Sweden	40,559	75,569	40,357
Western Germany	34,401	33,622	66,888
Netherlands	43,433	59,279	38,811
France	104,127	160,775	149,231
Spain	74,873	74,470	37,951
Italy	7,007	63,140	124,159
U.S. America	122,358	243,558	97,185
Other foreign countries	271,187	229,178	302,480

IMPORTS OF MACHINE TOOLS

New, complete—			
Boring and broaching machines	240,873	228,901	85,508
Drilling machines	78,971	17,436	16,122
Gear-cutting machines	115,373	142,446	13,691
Grinding, lapping and honing machines	342,141	302,537	229,332
Lathes:			
Automatic	238,157	225,789	282,399
Other	32,808	62,473	12,480
Milling machines	323,373	256,276	289,337
Planing, shaping and slotting machines	55,366	20,806	48,270
Presses	67,118	62,985	62,312
All other machines	557,807	346,554	348,694
Used machines, complete	255,303	18,939	43,470
Parts	264,965	394,098	274,430
Total	2,572,255	2,079,240	1,706,045
Country of Origin			
Western Germany	866,139	804,313	518,181
Switzerland	290,839	214,184	269,785
U.S. America	1,038,430	731,388	455,718
Other foreign countries	376,847	329,355	462,361

Coming Events

INCORPORATED PLANT ENGINEERS. *Dundee Branch.* April 7, at 7.30 p.m., at Mathers Hotel, Dundee; paper on "The Uses of Electronics," by R. B. Smith.

INSTITUTION OF PRODUCTION ENGINEERS. *London Graduate Section.* April 1, at 7.15 p.m., at the Institution of Production Engineers, 10 Chesterfield Street, W.1; lecture on "The Application of Spark Erosion Machining," by A. J. Lawrence.

INSTITUTION OF ENGINEERING DESIGNERS. *Midland Branch.* April 2, at 7.45 p.m., at the Queen's Hotel, Birmingham; films by British Oxygen Gases, Ltd., "The Flame Hardening Process" and "Advanced Oxy-acetylene Welding Techniques."

INSTITUTION OF ENGINEERING INSPECTION. *North-West Coast Branch.* April 11, at 7.45 p.m., at the Clifton Hotel, Talbot Square, Blackpool; paper, illustrated by films, on "The Heat Treatment of Aluminium Alloys," by E. Elliott.

Machine Tool Share Market

Stock markets which had been mainly dull, with very quiet conditions, developed firmness following the reduction in Bank Rate from 7 per cent to 6 per cent, and the past week finished on a cheerful note, with improvements in nearly all sections.

The gilt-edged market, after slight setbacks, became fairly active and strong, and, on balance, there were substantial gains in British Funds and other high-grade investment stocks.

Early dullness and irregularity in commercial and industrial share markets gave place to generally bright conditions, and leading sections finished well, with a long series of advances in prices.

Among machine tool issues, British Oxygen advanced 1s. 6d. to 35s.; Brooke Tool, 6d. to 5s. 6d.; Clarkson Engineers, 6d. to 11s.; Geo. Cohen, 6d. to 11s. 6d.; F. Pratt, 6d. to 20s. 6d.; Kerry's (Gt. Britain), 3d. to 5s. 9d.; and Thos. W. Ward, 1s. to 74s. 3d. On the other hand, Edgar Allen lost 3d. at 28s. 3d.; Stedall & Co., 3d. at 4s. 6d.; Coventry Gauge & Tool, 1s. at 12s. 6d.; and Wadkin Ltd., 9d. at 18s. 9d.

CLARKSON (ENGINEERS), LTD.—Final dividend 12½ per cent, making a total distribution of 20 per cent for the year ended November last.

MODERN ENGINEERING MACHINE TOOLS, LTD.—Interim dividend 12 per cent.

COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	9d.
Armstrong, Stevens & Son, Ltd.	Ord.	5/-	7/9
Allen (Edgar) & Co., Ltd.	Ord.	£1	28/3
" "	5% Prf.	£1	14/9*
Arnott & Harrison, Ltd.	Ord.	4/-	14/-
Asquith Machine Tool Corp., Ltd.	Ord.	5/-	18/9
" " "	6% Cum. Prf.	£1	17/9
Birmingham Small Arms Co., Ltd.	Ord.	£1	24/6
" " "	5% Cum. "A" Prf.	£1	15/-
" " "	6% Cum. "B" Prf.	£1	17/6
" " "	4% Ist. Mort. Deb.	Stk.	85/-
British Oxygen Co., Ltd.	Ord.	£1	35/-
" " "	6½% Cum. Prf.	£1	21/6
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	5/6
Broom & Wade, Ltd.	Ord.	5/-	9/9
" "	6% Cum. Prf.	£1	17/9xd
Brown (David) Corporation, Ltd.	5½% Cum. Prf.	£1	14/4½
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	17/6
Butler Machine Tool Co., Ltd.	Ord.	5/-	6/3
" " "	5% Cum. Prf.	£1	13/9
C.V.A. Jigs, Moulds & Tools, Ltd.	5½% Red. Cum. Prf.	£1	13/9
Churchill (Charles) & Co., Ltd.	Ord.	2/-	4/6
" " "	6% Cum. Prf.	£1	26/3†
Churchill Machine Tool Co., Ltd.	Ord.	5/-	17/6
" " "	6% Cum. Prf.	£1	18/9
Clarkson (Engrs.), Ltd.	Ord.	5/-	11/-
Cohen (George), Son & Co., Ltd.	Ord.	5/-	11/6xd
" " "	4½% Cum. Prf.	£1	14/6xd
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	12/6
" " "	5% Cum. Red. Prf.	£1	16/3
Coventry Machine Tool Works, Ltd.	Ord.	4/-	9/-
Craven Bros. (Manchester), Ltd.	Ord.	5/-	6/-
Elliott (B.) & Co., Ltd.	Ord.	1/-	3/-
" "	4½% Red. Cum. Prf.	£1	13/9
Export Tool & Case Hardening Co., Ltd.	Ord.	2/-	1/6
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	12/-xd
Greenwood & Batley, Ltd.	Ord.	£1	46/10½
Harper (John) & Co., Ltd.	Ord.	5/-	13/6
" "	4½% Red. Cum. Prf.	£1	13/1½
Herbert (Alfred), Ltd.	Ord.	£1	62/6xd
Holroyd (John) & Co., Ltd.	"A" Ord.	5/-	10/6
" "	"B" Ord.	5/-	9/9
Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	21/3
" " "	7% Cum. Prf.	5/-	5/-
Kayser, Ellison & Co., Ltd.	Ord.	£1	49/-
" " "	6% Cum. Prf.	£1	18/3
Kendall & Gent, Ltd.	Ord.	5/-	7/9
Kerry's (Gt. Britain), Ltd.	Ord.	5/-	5/9
Kitchen & Wade, Ltd.	Ord.	4/-	10/3
Martin Bros. (Machinery), Ltd.	Ord.	2/-	2/4½
Massey, B. & S., Ltd.	Ord.	5/-	7/3
Modern Engineering Machine Tools, Ltd.	Ord.	5/-	10/-
Newall Engineering Co., Ltd.	Ord.	2/-	5/-
Newman Industries, Ltd.	Ord.	2/-	2/9
" "	6% Prf. Ord.	5/-	5/6
Noble & Lund, Ltd.	Ord.	2/-	4/9
Osborn (Samuel) & Co., Ltd.	Ord.	5/-	16/3
" " "	5½% Cum. Prf.	£1	24/6xd
Pratt (F.) & Co., Ltd.	Ord.	5/-	20/6
Scottish Machine Tool Corporation, Ltd.	Ord.	4/-	5/3
Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	33/6
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	11/4½
Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	35/-
" " " "	5% Cum. Prf.	£1	15/-
Stedall & Co., Ltd.	Ord.	5/-	4/6
Tap & Die Corporation, Ltd.	Ord.	5/-	7/9
" " "	4½% Deb. 1961-1977	Stk.	82/-
Wadkin, Ltd.	Ord.	10/-	18/9
Ward (Thos. W.), Ltd.	Ord.	£1	74/3xd
" "	5% Cum. Ist. Prf.	£1	15/6
" "	5% Cum. 2nd Prf.	£1	24/3
Willson Lathes, Ltd.	Ord.	1/-	2/4½

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. † Birmingham price.

PRICES OF MATERIALS

All prices per ton except where otherwise stated.

Pig-Iron

Foundry and Forge No. 3, Class 2	
Middlesbrough zone	£21 6 0
Birmingham	£20 18 3
Phos. 0·1 to 0·75%	
Birmingham	£23 17 0
Scottish Foundry	
Grangemouth	£25 3 6
Hæmatite	
English No. 1	
N.E. and N.W. Coast	£25 6 6
Scotland	£25 13 0
Sheffield	£26 15 0
Birmingham	£27 4 0
Welsh	£25 6 6

Steel Products

Medium plates	£46 1 6
Mild steel plates, ordinary*	£42 12 0
Boiler plates*	£45 2 0
†Flat bars 5 in. wide and under / †Round bars under 3 in.	£40 8 0
Billets, rolling quality, soft U.T.	£33 1 6

Phosphor Bronze

Ingots (2B8) (A.I.D.)*d/d	£235 0 0

Copper

Cash (mean)	£178 2 6
Cold rolled and hot rolled Sheets 4 ft. by 2 ft. by 10 SWG	£239 5 0—£239 10 0
Rods $\frac{7}{16}$ in. to $\frac{1}{2}$ in. diam.	£259 15 0
Tubes, 1$\frac{1}{2}$ in. bore by 10 SWG, ton lots, per lb.	2s. 5$\frac{1}{2}$d.
Wire rod, black, hot-rolled ($\frac{1}{4}$-$\frac{7}{16}$ in.) English	£193 12 6

Zinc

Refined, minimum 98 per cent. purity, current month (mean)	£63 17 6

Brass

Tubes, solid drawn, per lb.	1s. 5d.
Strip 63/37, 6 in. by 10 SWG coils, ton lots £207 0 0—£209 10 0	
Rods, $\frac{1}{2}$-3 in. diam. (59 per cent copper)	1s. 8$\frac{1}{2}$d.

Yellow Metal

Condenser plates, per ton	£145 0 0
Rods, per lb.	1s. 9$\frac{1}{2}$d.

Aluminium

Ingots min. 99·5 per cent Canadian d/d	£197 0 0

Lead

Refined, minimum 99·97 per cent purity, current month (mean)	£75 16 3

Tinplates

‡U.K. Home trade:	
Handmill f.o.t. makers' works	£3 12 2$\frac{1}{2}$
Cold reduced, f.o.t. makers' works	£3 7 10$\frac{1}{2}$
U.K. Export:	
Hot rolled basis, f.o.t. works' port	74s. 0d.—75s. 0d.
Cold reduced basis, f.o.t. works' port	76s. 0d.

Gunmetal

Ingots, 85.5.5.5. ex works	£150 0 0

* N.E. Coast, N. Joint Area, Central Scottish Zone.

† U.T. soft basic.

‡ Official maximum price, after allowing for adjustments for increase in price of tin.

MAKERS' PRICES

Hexagon Steel Bars[1]

Sizes in inches from 0·7049 up to 2·21 and 2·41 a/f, ex works basis	£43 4 6
Free cutting black	£47 10 0

Reeled Steel Bars[1]

Single-reeled 1$\frac{1}{2}$ in. upwards, f.o.t. works (+ usual extra for sizes)	£43 17 6
Free cutting	£48 2 6

High-Speed Steel

Black random length bar. All prices basic, per lb., subject to extras.	
Molybdenum "66"	5s. 10$\frac{1}{2}$d.
Molybdenum "46"	5s. 8$\frac{1}{2}$d.
14 per cent tungsten	5s. 9d.
16 per cent tungsten	6s. 1$\frac{1}{2}$d.
18 per cent tungsten	6s. 4d.
22 per cent tungsten	7s. 5d.
5 per cent cobalt	9s. 6d.
4·75/5·25 per cent molybdenum + 6·0/6·75 per cent tungsten + 1·75/2·05 per cent vanadium (5-6-2)	6s. 0$\frac{1}{2}$d.

Precision-ground, High-speed Free-turning Brass Rod[2]

$\frac{1}{8}$-in. dia. ± 0·00025-in. 2-ton lots, per lb.	2s. 2$\frac{1}{2}$d.

Grey Iron Rod

Die Cast[3] in 7 random lengths 18 in. to 24 in. rough machined $\frac{1}{32}$-in. above listed size. Extra for definite lengths, for hardenable alloy iron, and for orders of less than £50. Discounts for orders over £150.

	Per cwt. net. Mark I	Mark III
$\frac{3}{4}$ or $\frac{7}{8}$ in.	255s. 6d.	318s. 10d.
1 or 1$\frac{1}{4}$ in.	204s. 4d.	251s. 10d.
1$\frac{1}{2}$ to 1$\frac{3}{4}$ In.	143s. 0d.	171s. 2d.
1$\frac{7}{8}$ to 2 in.	106s. 2d.	125s. 11d.
2$\frac{1}{8}$ to 3$\frac{1}{2}$ in.	91s. 6d.	106s. 4d.
3$\frac{3}{4}$ to 12 in.	86s. 6d.	99s. 2d.

Continuous Cast

10-ft. lengths, centreless machined 1 to 3-in. dia. + 0·010 to 0·020 in., prices as quoted for die cast bar[3]

6-ft. lengths	$\frac{3}{4}$ or $\frac{7}{8}$ in.	245s. 4d.
centreless ground + 0·010 in. Extra	1 or 1$\frac{1}{4}$ in.	196s. 4d.
for hardenable alloy iron[4]	1$\frac{1}{4}$ to 1$\frac{3}{4}$ in.	137s. 10d.
Per cwt. net	1$\frac{7}{8}$ to 2 in.	106s. 2d.
	2$\frac{1}{8}$ to 3 in.	91s. 6d.

Stellite[5]

Welding Rods plain

$\frac{1}{4}$ in. dia. per lb.	30s. 0d.

Toolbits

$\frac{1}{4}$ in. sq. × 4 in., each	22s 3d.

Precision-ground Mild Steel[3]

1-in. dia. + 0·00025-in. 4-ton lots, per cwt.	121s. 6d.

1 Colvilles, Ltd., Glasgow, and 17 Grosvenor Street, London, W.1. 2 Pratt, Levick & Co., Ltd., Chester. 3 Sheepbridge Alloy Castings, Ltd., Sutton-in-Ashfield. 4 "Flocast," Harold Andrews Sheepbridge, Ltd., Halesowen. 5 Deloro Stellite, Ltd., Highlands Road, Shirley, Solihull.

BASIC PRICES FROM LONDON STOCK[6]

Free Cutting Steel

Bright cold drawn:	
(Usaspead) over 1$\frac{1}{2}$ to 2 in.	£59 17 6
Lead bearing (Usaled)	£63 17 6
Precision ground, 1$\frac{3}{4}$ in.	£81 12 6

Bright Drawn

M.S. bars (M.M.C.) over 1$\frac{1}{2}$ in. to 2 in.	£55 8 6
Square edge flats (Usaflat)	£72 5 0
M.S. angles (Usaspead)	£99 10 0
Casehardening (EN) (Usacase) over 1$\frac{1}{2}$ in. to 2 in.	£63 14 6
M.S. bars (EN3B) (Usamild) over 1$\frac{1}{2}$ to 2 in.	£57 8 6
Carbon manganese semi-freecutting case hardening (EN202) (Usaspead 202) over 1$\frac{1}{2}$ to 2 in.	£71 14 0
35/45 ton tensile (EN6) (Usen) over 1 to 1$\frac{1}{2}$ in.	£65 2 6
0·4 Carbon Normalised (Usaspead "40") over 1$\frac{1}{2}$ in. to 2 in.	£67 4 6
Carbon manganese steel to Specification EN.16.T (Usaspead 5565), per ton	£127 10 3

Ground Flat Stock

18-, 24-, and 36-in. lengths (Usaspead). List prices less 5 per cent

Oil Hardening Cast Steel

Non-shrink (Usaspead N.S.O.H.) $\frac{3}{4}$ in. to 2$\frac{1}{2}$ in., per lb.	1s. 11d.
Non-distorting heavy duty (Usaspead H.C.H.C.) $\frac{3}{4}$-in. to 2$\frac{1}{2}$-in., per lb.	4s. 2d.

Silver Steel

(0·194-in. to 1$\frac{1}{4}$-in.) Genuine Stubs quality, per lb.	4s. 6d. less 27$\frac{1}{2}$%
M.M.C. quality, per lb.	2s. 5d. + 6$\frac{1}{2}$%
Boxes of 16 assorted sizes $\frac{1}{16}$-in. to $\frac{1}{2}$-in. dia.	7s. 6d.

Stainless Steel

K.E. 40.AM (Freecutting), per lb.	3s. 3$\frac{1}{2}$d.

Glacier Machined Bronze Bars

Phosphor bronze (2B8) / Lead bronze	Prices on application

High-speed Steel

18 per cent tungsten. Prices on application.

Toolholder bits:	
Usaspead "Super" / "Supreme" / "Cobalt 10"	List price

Shimstock

Steel assorted, per tin	3s. 6d.
Brass " "	7s. 3d.

6 Macready's Metal Co., Ltd., Pentonville Road, N.1. Subject to confirmation by London Office. Delivered free by van in London area.